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Formerly ELECTRONIC INDUSTRIES

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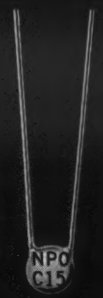
At right, Admiral John R. Redman, Director of Communications for the Navy which this year will spend $500,000,000 for radio-electronic equipment.

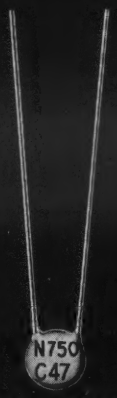
Another FIRST by RMC

Temperature Compensating and General Purpose DISCAPS



Body Size 1/4" Dia.

Available Range	
MMF	TC
—	—
5 to 15	NPO
5 to 15	N33
5 to 15	N75
5 to 15	N150
5 to 15	N220
5 to 15	N330
5 to 20	N470
10 to 25	N750
15 to 50	N1500
50 to 100	N2200



Body Size 5/16" Dia.

Available Range	
MMF	TC
2 to 9	P100
16 to 33	NPO
16 to 30	N33
16 to 30	N75
16 to 30	N150
16 to 30	N220
16 to 30	N330
21 to 40	N470
26 to 50	N750
51 to 80	N1500
100 to 150	N2200

Body Size 1/2" Dia.

Available Range	
MMF	TC
10 to 30	P100
31 to 60	NPO
31 to 60	N33
31 to 60	N75
31 to 60	N150
31 to 75	N220
31 to 75	N330
41 to 100	N470
51 to 150	N750
81 to 200	N1500
150 to 250	N2200

Body Size 5/8" Dia.

Available Range	
MMF	TC
—	—
61 to 75	NPO
61 to 75	N33
61 to 75	N75
61 to 75	N150
76 to 100	N220
76 to 100	N330
101 to 125	N470
151 to 200	N750
201 to 250	N1500
250 to 300	N2200

Specifications

POWER FACTOR: LESS THAN .1% AT 1 MEGACYCLE
WORKING VOLTAGE: 600 VDC TEST VOLTAGE 1200 VDC
DIELECTRIC CONSTANT: P-100 14K N-750 88K N-2200 265K NPO 35K N1500 165K
CODING: CAPACITY, TOLERANCE AND TC STAMPED ON DISC
INSULATION: DUREZ PHENOLIC—VACUUM WAXED
MIN. LEAKAGE RESISTANCE: INITIAL 5000 MEGOHMS AFTER HUMIDITY 1000 MEGOHMS
LEADS: #22 TINNED COPPER (.026 DIA.)
LEAD LENGTH: 1/4" BODY 1", 5/16" BODY 1-1/4", 1/2" BODY 1-1/2"
TOLERANCES: ±5% ±10% ±20%

SEE US—BOOTH 338—I. R. E. SHOW

Designed to Replace Tubular Ceramic and Mica Condensers at LOWER COST

RMC Type C DISCAPS conform to the electrical specifications of the RMA RC-107 standard for Class 1 ceramic capacitors. Their capacity will not change under voltage.

Type C DISCAPS offer for the first time low inductance, disc type temperature compensating ceramic condensers which are ideally suited to coupling and tuned circuit applications. Because they are available in a wide range of capacities and temperature coefficients, their usefulness is practically unlimited.

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Edited for the 15,000 top influential engineers in the Tele-communications industry, TELE-TECH each month brings clearly written, compact, and authoritative articles and summaries of the latest technological developments to the busy executive. Aside from its engineering articles dealing with manufacture and operation of new communications equipment, TELE-TECH is widely recognized for comprehensive analyses and statistical surveys of trends in the industry. Its timely reports and interpretations of governmental activity with regard to regulation, purchasing, research, and development are sought by the leaders in the many engineering fields listed below

•

Manufacturing

TELEVISION • FM
LONG & SHORT WAVE RADIO
AUDIO AMPLIFYING EQUIPMENT
SOUND RECORDERS & REPRODUCERS
AUDIO ACCESSORIES

MOBILE • MARINE • COMMERCIAL
GOVERNMENT
AMATEUR COMMUNICATION
CARRIER • RADAR • PULSE
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—

Research, design and production of special types
TUBES, AMPLIFIERS, OSCILLATORS, RECTIFIERS, TIMERS, COUNTERS, ETC. FOR
LABORATORY • INDUSTRIAL USE
ATOMIC CONTROL

Operation

Installation, operation and maintenance of telecommunications equipment in the fields of

BROADCASTING • RECORDING
RADIO & SOUND • MUNICIPAL
MOBILE • AVIATION
COMMERCIAL • GOVERNMENT

APRIL 1951

COVER: Rear Admiral John R. Redman, U.S.N., Director of Naval Communications, is here shown with the Assistant Director, recently Captain, now Rear Admiral William B. Ammon. Captain Ammon's promotion to Admiral rank was confirmed by the Senate late in January. Admiral Ammon's next assignment is as Commander of Destroyer Flotilla 3, in the Pacific. The Navy's expenditure for radio-electronic equipment in the Rearmament Program is expected to exceed half a billion dollars during 1951.

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Test, Grade, or Match Resistors

"as fast as you can pick 'em up!"

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RESISTANCE COMPARATOR

Just place the "unknown" resistance across the terminals of this precision, production Clippard tester. Even unskilled operators can process up to 17 resistors (of all types) *per minute.* Working to an accuracy of better than ±1% through the entire range of 100 ohms to 100 megohms, the PR-5 is a companion instrument to the famous PC-4 Automatic Capacitance Comparator. With it, radio, electrical, resistor manufacturers and large part jobbers save time and money and assure unerring accuracy of inspection.

Completely self-contained, the PR-5 requires no outside attachments other than the Standard Resistor against which unknowns are checked. Operates on 110 Volt—60 Cycle AC. Range: 100 ohms to 100 megohms; reads deviation from standard on any of three scales: —5% to +5%, —25% to +30% or —50% to +100%. Size: 18" x 12" x 12". Weight: approx. 32 lbs. For complete details, write for Catalog Sheet 4-TT.

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M. H. NEWTON, *Business Manager*
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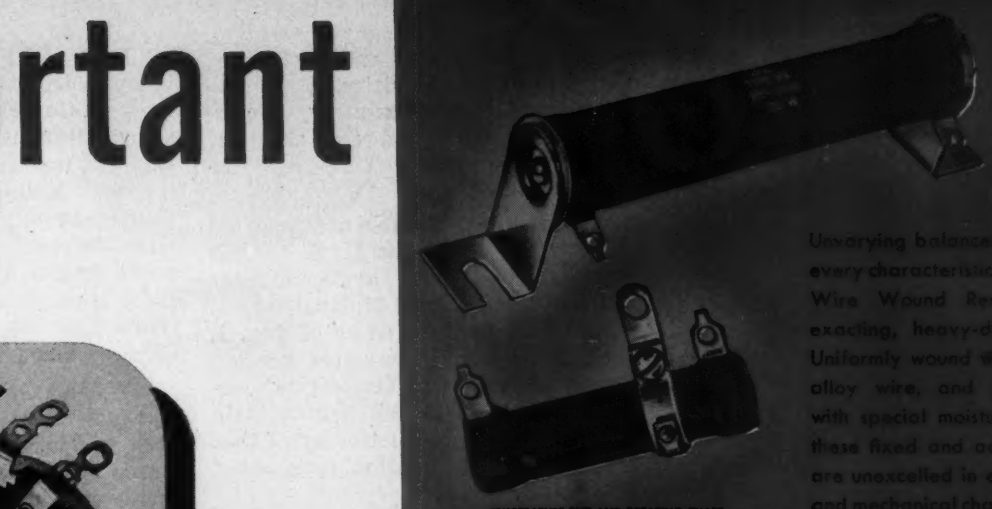
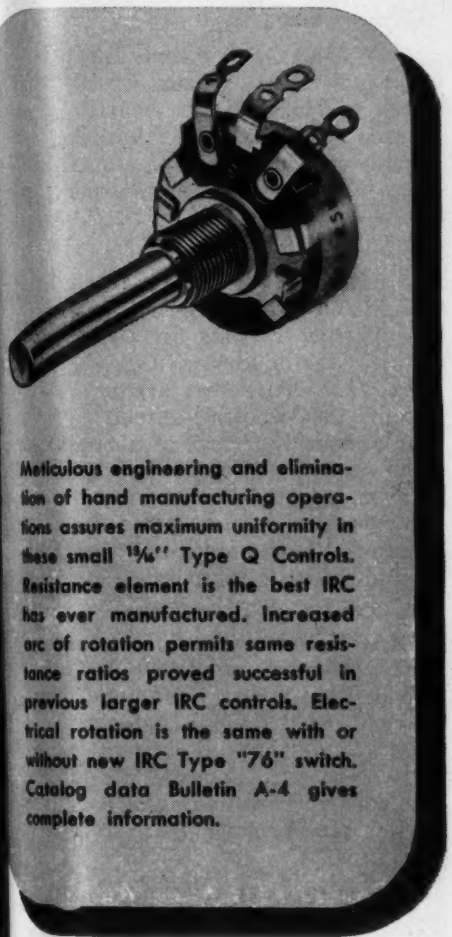
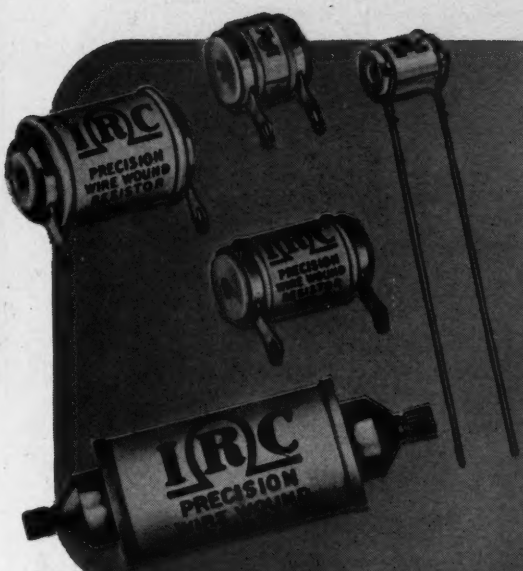


Unvarying balanced performance in every characteristic makes IRC Power Wire Wound Resistors ideal for exacting, heavy-duty applications. Uniformly wound with highest-grade alloy wire, and precisely coated with special moisture-proof cement, these fixed and adjustable resistors are unexcelled in essential electrical and mechanical characteristics. Leading industrial, aircraft, broadcast, maritime and commercial users have specified them for over 14 years. Catalog data Bulletin C-2 contains full details.



Meticulous engineering and elimination of hand manufacturing operations assures maximum uniformity in these small 1⅛" Type Q Controls. Resistance element is the best IRC has ever manufactured. Increased arc of rotation permits same resistance ratios proved successful in previous larger IRC controls. Electrical rotation is the same with or without new IRC Type "76" switch. Catalog data Bulletin A-4 gives complete information.



Uniformly accurate and dependable, IRC Precision Wire Wounds excel in every significant characteristic. Leading instrument makers use them extensively for close tolerance applications. Winding forms are non-hygroscopic ceramic with high insulation qualities, high mechanical strength, low coefficient of expansion. Special humidity-proof enamelled-wire windings receive particular attention to avoid strain or breakdown in insulation. Standard 1.0% tolerance. ½, ¼ and 1/10% are available. Full details in catalog data Bulletin D-1.

• Voltmeter Multipliers • Insulated
• Low Wattage Wire
• Volume Controls • Voltage Dividers
Wire Wounds • Deposited Carbon
• Ultra-HF and High Voltage Resistors

Whatever the Circuit Says

prompt delivery of uniformly dependable standard resistors, in experimental, maintenance quantities, simply phone your local IRC Distributor. IRC's Industrial Service Plan keeps him fully stocked with the most wanted types and ranges—permits him to give you fast, round-the-corner delivery of small-order requirements. We'll be glad to send you his name and address.

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- ☐ Advanced BT Resistors (B-1)
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- ☐ Precision Wire Wounds (D-1)
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COMPANY_____

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TELE-TIPS

IRON CURTAIN—The State Department has just completed the delivery of 200,000 combined AM-shortwave receivers into the Iron Curtain countries. The sets were purchased for about $16 each, from American manufacturers. Even inside Russia the Soviet masters only "discourage" listening to outside radio stations, but impose no penalties, fines, imprisonment or executions for so doing, as was the rule during the Nazi regime in Germany.

45,875,000 HOMES are reported as of April, 1950, by U. S. Census Bureau, from which (at recent rates of growth) a total of 47,500,000 total homes may be deduced as of Jan. 1, 1951. This figure compares reasonably with January TELE-TECH's estimate of 45,000,000 homes with radio, since all authorities agree that present radio saturation runs about 95%.

Engineering Achievement

Since the Eiffel Tower was first opened 62 years ago this month it has thrilled millions and become a world-famous Parisian landmark, standing as a monument to the engineering skill of its builder.

Similarly the "T. E. I." insigne of Thomas is a hallmark of picture tube engineering and production skill known throughout the television industry. More than one-half million homes today enjoy the finest television reception on Thomas picture tubes.

For, manufacturers, distributors, and servicemen alike know that when they buy Thomas, they buy an engineering achievement! See just how good a tube **can** be — try Thomas!

THOMAS ELECTRONICS, Inc.

CIVIL DEFENSE activities are now headed by Millard F. Caldwell, former Governor of Florida, with Robert Burton (ex "Voice of America") as top technical chief at Washington. Mobile and walkie-talkie equipment will be purchased by local home-defense groups, but CDA expects to get own funds for special radio apparatus to be supplied target cities like Washington, New York, Chicago and Los Angeles.

NY MAYOR Vincent Impellitteri was a wireless operator in the Navy back in World War I. Shortly afterward, CBS's famed Arthur Godfrey (now with $10,000,000 annual billings) started his radio career as a radio operator in the U. S. Coast Guard.

"FRINGE" RECEPTION in England is now receiving the same treatment that it gets in the United States. In Gloucester, 95 miles from London, 1,000 homes are to be connected to a multiple-antenna system for a monthly charge of about $1.25. The system will be in operation by May 1. A receiving installation will be mounted on a high point of ground just outside the town, and the signal fed to the main distributing point by microwave.

BAGHDAD on the Tigris is now linked directly with New York by a modern high-speed radiotelegraph circuit. RCA's Gen'l Ingles explains that establishment of this direct service to Iraq is made possible by the construction in Baghdad of new radio receiving and transmitting facilities.

LEAD-CALCIUM storage battery developed by Bell laboratories is declared to have 50% more life than present batteries. New cells require less replenishment of water, in fact operating for many months with no additional water. Loss of charge runs only 4% per month, compared with 20% loss by present storage batteries. In the new battery plates, one-tenth of 1% of calcium replaces the 12% of antimony, action of which was found to be producing internal discharges.

SOME PEOPLE HAVE HAD TO WAIT from 6 to 9 months for home telephone installations in the U. S. since the end of World War II; but in Cairo, Egypt, many business and residential applications have been pending for as long as five years! This is even worse than the lot of the three hundred-odd television applicants who have been waiting *only* thirty-one months for the FCC to end the freeze.

(*Continued on page* 14)

THE EVER GROWING PREFERENCE for Audiotape is largely a matter of *experience.*

Professional recordists started the trend to Audiotape because they knew, from long experience with Audiodiscs®, that Audio could always be depended on for consistent, uniform quality — to meet the most exacting requirements.

And the trend is continuing, in every field of sound recording, because *experience* with Audiotape proves its unequalled uniformity of output and freedom from background noise and distortion.

The superior magnetic and mechanical properties of Audiotape are the *result* of experience, too — more than a decade of engineering and production know-how by the *only* company in America devoted solely to the manufacture of fine sound recording materials — discs, tape and film.

That's why the Audiotape line has grown so large and so fast. In addition to the standard ¼" tapes, Audio is now supplying a wide variety of special sizes — up to 8" in width — for specialized applications of sound reproduction. The new Audiofilm*, developed for the motion picture and TV industries, is a typical example.

Whatever your magnetic recording requirements — for standard or special tapes — remember that you can always depend on Audiotape. Get in touch with your nearest Audiotape distributor, or write to our New York office.

**Trade Mark*

AUDIO DEVICES, INC.

PREPAREDNESS PRODUCTION *Enlists*

AMPHENOL

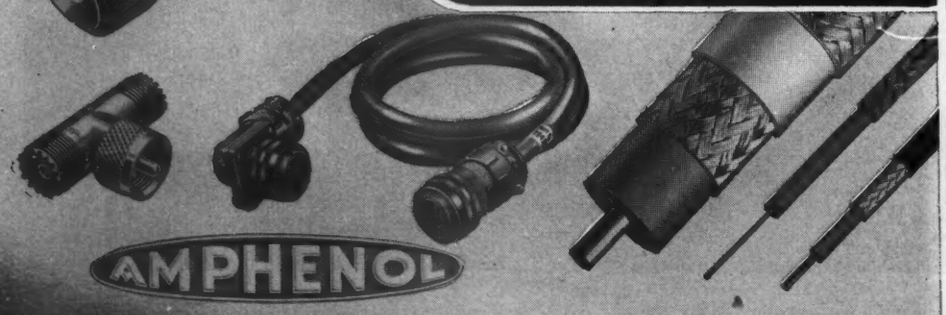
Vital to the Job of Defense

LEADS THE FIELD

Amphenol radio and electronic components — AM and RF connectors, plugs, sockets, cables — reflect the cooperative effort that exists between Amphenol engineers and both civilian and government engineers . . . an effort that develops many new *plus* features over and above specifications and keeps Amphenol ahead of the field!

NEW — RF CONNECTORS

New to Amphenol's UHF series are 2 cable-to-connector fittings and one right angle adaptor with a lower than usual V.S.W.R. A new "HN" angle plug is approximately 40% lighter than the usual adaptor-plug combination. Five new connectors feature Teflon insulation for low dielectric loss and operation up to 500° F. Also new are 4 pressurized panel receptables and modified "N" plugs, jacks, panel jacks and bulkhead panel jacks.



AMPHENOL

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TELE-TIPS (Continued)

FACSIMILE—Recent developments in the facsimile field by Western Union indicate that the old familiar telegraph type-printers in many of our business offices may soon be replaced with facsimile machines. From an initial cost and maintenance viewpoint, latter are less expensive.

250 PHILIPS U. S. patents were issued during 1950 to the Hartford National Bank & Trust Company as Philips Trustee. Philips thus stood seventh in the 1950 list of American companies leading in number of patents granted, but probably first with respect to patents based on inventions originating outside the U. S. A number of Philips patents pertain to improvements in color and black-white television and to projection-television optical devices. Others are on phosphor materials for television picture-tube screens and magnetic ferrite materials, which have important applications in components for television receivers. Also of significance are patents relating to recent developments in radio direction-finders, beacons and electronic altimeters for aircraft navigation and carrier telephony.

BC DRAFTEES—Broadcast stations may face acute employee shortages, particularly in the engineering groups, if the draft expands. Almost one-fourth of the industry's engineering personnel are in the 17-26-year-old age group, according to NAB. More than half of radio's workers—55.9%—are World War II veterans. Here also the engineers top the field, percentage-wise, with 60% who are ex-GI's. Another group of concern to station operators are those men who are licensed operators. Among the key personnel in a station, 22.1% fall in the 16-26 bracket. More than half of the engineering employees holding FCC tickets—57.4%—are ex-GI; 17.4% are in the reserves and 7.9% are reservists with no child dependents.

"THE WINDS and waves are always on the side of the ablest navigators" says TELE-TECH's occasional visitor "Salesman Sam" Himmel, who adds: "The world is not interested in the storms you encountered, but did you bring in the ship? . . . . The successful executive is a person who thinks deeply, plans thoroughly, and works long hours; for there is no Big Business without Big Effort!"

Music's immortals play again, sing again, in RCA Victor's "Treasury of Immortal Performances"

A treasury of **Music's Immortals**

Now artists whose names are musical legend live again for the modern listener. You can hear them, at their finest, in RCA Victor's "Treasury of Immortal Performances."

In recreating these performances on both 33 and 45 rpm, acoustical engineers drew on a vault of master records guarded for posterity by RCA Victor. But new electronic techniques, developed through RCA research, give the new records a quality far surpassing that of the originals.

Because RCA Victor could draw on so vast a storehouse of the past, there is something in the "Treasury of Immortal Performances" for listeners of every age and taste. Caruso sings light and serious music—as do Schumann-Heink, Mary Garden, and others . . . Paderewski is here . . . and, if your taste is for popular music, such greats as Berigan, Armstrong, Waller, in rare early records.

* * *

See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, N. Y. 20, N. Y.

The magic of RCA Victor's "45" system—as an independent unit, or combined with radio or television receivers—has already led 55 record-makers to adopt it.

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World Leader in Radio — First in Television

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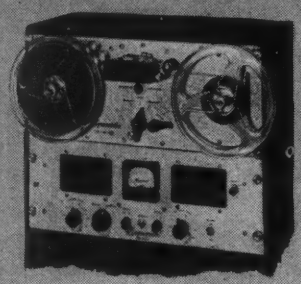
Magnecorder

THE FIRST CHOICE OF RADIO ENGINEERS

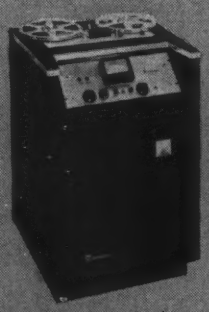
FLEXIBILITY

In rack or console, or in its really portable cases, the Magnecorder will suit every purpose. PT6 Series shown is the most widely used professional tape recorder in the world, and is available with 3 speeds (3¾", 7½", 15") if preferred.



FIDELITY

Lifelike tone quality, low distortion meet N.A.B. standards — and at a moderate price! PT63 Series shown in rack mount also offers three heads to erase, record, and play back to monitor from the tape while recording.



FEATURES

PT7 accommodates 10½" reels and offers 3 heads, positive timing and pushbutton control. PT7 Series shown in complete console model is also available for portable or rack mount. For outstanding recording equipment, see the complete Magnecord line — PT6, PT63 and PT7.

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Send me latest catalog of Magnecord Equipment.

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Address.....

City.....Zone.....State.....

Expansion Plans of SMPTE

A program of expansion for 1951 has been adopted by the Society of Motion Picture and Television Engineers, with producers, exhibitors and broadcasters, all looking for technical ways to improve program quality and at the same time to reduce production and operating costs. The Society has already started work on a 4-point plan:—

1. Society Headquarters in New York, under Boyce Nemec, Executive Secretary, will acquire additional office space in the metropolitan area and will employ additional personnel.

2. The Society's Journal and other technical publications activity now under the guidance of John G. Frayne of Westrex, SMPTE editorial vice-president and Victor Allen, Editor, will be increased 72% over 1950.

3. Membership procedures have been streamlined and an additional Admissions Committee appointed to accommodate membership growth from all branches of motion pictures, television, and high-speed photography.

4. Technical activities under Fred Bowditch of National Carbon, SMPTE engineering vice-president, and Henry Kogel, Society staff engineer, which include engineering projects and test films will expand greatly. Increase of as much as 100% has been provided for in the Society's 1951 Budget.

AFCA Hears Ingles on New Unification Need

Armed forces unification in communications was fact rather than theory during World War II, as evidenced by the top-flight cooperation between Army and Navy signal commands. Reciprocal arrangements and preplanning made it unnecessary for the Navy to install or operate any extensive communications system in Australia and the Army, in turn, used Navy facilities exclusively at Casablanca. Duplication of effort and materiel was wisely avoided.

But "unification" in another sphere of our defense network, that of military and privately-owned communications systems, is not even in the talking stage, according to a recent statement before the Armed Forces Communication Assoc. by Major General Harry C. Ingles, USA (ret.). The former chief signal officer of the Army has found that many commercial companies not only have adequate facilities to handle civilian traffic but are quite capable of handling a large amount of military communications as well. If we ever find ourselves embroiled in a world-wide conflict again, it would be wise for the military to lease commercial facilities rather than attempt to duplicate them in countries which are used as major bases or staging areas. Skilled military personnel and materiel will be used to their best advantage and the taxpayer will not be left holding the bag at war's end when millions of dollars worth of communications equipment is liquidated at a fraction of its cost.

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O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

Why Not Partially LIFT THE "FREEZE" NOW?

The spectacle of Honolulu's being denied a television station because of the "freeze", although obviously there could be no interfering TV station within 3000 miles of bright, blue Pacific Ocean, caps the absurdity of the continued FCC barrier. Denver is another city caught in the freeze, needlessly depriving a million plains and mountain people of TV.

★ ★ ★

It is now nearly 30 months since the FCC clamped its 90-day freeze on new grants to telecasters. In that time the original issues have been expanded to include even color and educational TV! Three hundred and seventy-six applications for construction permits are pending, many of which are for facilities in cities without TV service. In just six of the cities denied service there are over 2,500,000 people.

★ ★ ★

Let the fate of the UHF channels rest awhile, until the National Emergency is past. There is no equipment available for use at these frequencies. Let color-TV remain the dead issue it is at present. Let educational TV work out a cooperative deal with telecasters—for not many institutes of learning can afford television stations with today's diminishing enrollments.

BUT LET THERE BE A *LIMITED* LIFTING OF THE FREEZE! The cities which now have no outlets should be assigned temporary channels which could be used on the understanding that after the eventual allocations plan is decided, the frequencies might be reviewed and subject to change. Embryo telecasters should jump at the opportunity, and whole centers of population would be able to receive much needed television instruction in defense measures.

★ ★ ★

There is no valid engineering reason why the VHF TV allocation should wait upon the determination of the UHF, color, and educational hearings. At a time like the present the FCC should put aside its high falutin' ideals of geometrical precision in TV frequency allocation and realize that people living in non-TV areas have need of the existing *completely satisfactory* VHF service. The allocation of a few VHF channels today would not seriously impair future plans if it were made clear that the channels were temporary. Too many people have suffered from lack of TV too long,—while bureaucrats demur. This condition is not confined to democracies, for many years ago Horace commented *quicquid delirant reges, plectuntur Achivi,* which being literally translated means, "whenever the great do foolish things, the people suffer!"

Let's partially lift the "Freeze", Now!

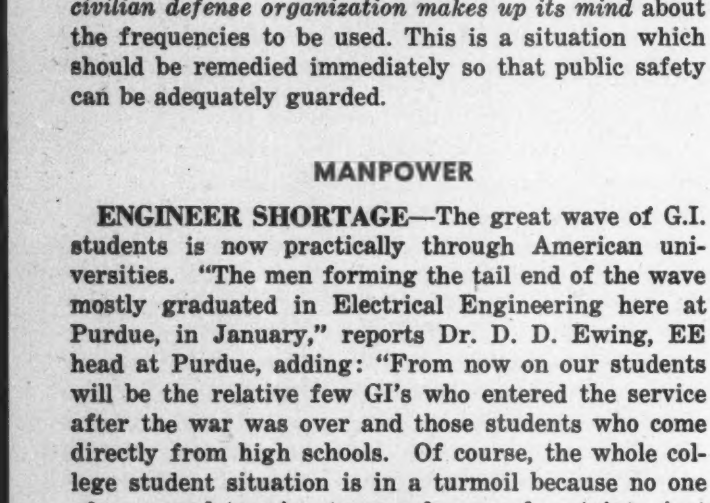
The RADARSCOPE *Revealing at a Glance*

DEFENSE

MOST PRESSING JOB to be done at the moment in civilian defense is the selection and designation of frequencies to be used by the defense organizations in the radio alerting and calling systems. This decision has hung since 1941 when the subject was first considered. Representatives of the radio industry have suggested codes which provide all the necessary information in the available frequency range, and the FCC has provisional regulations to cover the use of this type of transmission carried over from the last war. But manufacturers cannot go ahead on the production of the essential radio communication units *until the civilian defense organization makes up its mind* about the frequencies to be used. This is a situation which should be remedied immediately so that public safety can be adequately guarded.

MANPOWER

ENGINEER SHORTAGE—The great wave of G.I. students is now practically through American universities. "The men forming the tail end of the wave mostly graduated in Electrical Engineering here at Purdue, in January," reports Dr. D. D. Ewing, EE head at Purdue, adding: "From now on our students will be the relative few GI's who entered the service after the war was over and those students who come directly from high schools. Of course, the whole college student situation is in a turmoil because no one of us can determine to any degree of certainty just how many students the draft boards will leave us even for next semester. Of one thing we are very certain; namely, that for the next several years there is going to be an enormous shortage of engineers. A couple of years ago certain governmental bodies and professional associations were bemoaning the fact that there were so many engineering students in colleges at that time. They feared the profession would be greatly overcrowded. As a matter of fact, we graduated 546 EE students with Bachelors degrees in the year 1948-49, and 526 in the year 1949-50, and as far as I know now they all have positions. We could place hundreds of others if we had the men. So, if we are short of engineers now, I just do not know what is going to happen to us a year or two from now when our classes will be down to an even lower level than the prewar levels."



VHF transmitting and receiving equipment operated by U. S. soldier halfway up a mountain at Kawsong, Korea.

MICROWAVE

RELAY REPEATERS—New, less costly, microwave-relay repeater designs may be available in the very near future because of the development work being done in connection with "traveling-wave" tubes. The equipment cost factor of current designs comes about because signal amplification is accomplished at an intermediate frequency thus involving frequency conversions from the incoming and to the outgoing r-f. The broadband characteristic of traveling wave tubes makes direct amplification possible and permits a slight frequency shift between incoming and outgoing r-f signals to avoid feedback problems.

AUDIO

REVERBERATION—New trend in the recording industry is to permit more reverberation in the recording of selections to achieve a more lively result. Although along the subject of divided opinion, many Americans have felt that the products of English recording companies are more pleasing than ours, the chief complaint having been that our recordings sounded "dead." Difficulties have been encountered with the experiments now in progress because it seems that the acoustics in American structures are not what they are in English architecture, and there are unanswered questions as to whether the acoustics in the latter are the result of design or just plain luck!

ENERGY SOURCES

PORTABLE POWER—In the early days of radio on aircraft, indeed, up to the beginning of World War II, generators mounted on the outside of the fuselage were used by aircraft to provide power for their radios. Now the railroads are following suit—not with windmills breaking the sleek lines of the streamliners—but with air driven generators powered from the air line which operates the brakes. This solves the problem of powering cabooses and other cars which do not normally carry lighting plants. This source of electrical power could also be applied to buses and other large vehicles which require heavy current sources and have air supplies in the form of airbrakes. Perhaps aircraft generators could be driven by hydraulic power and thus remove another source of fire hazard from the engines?

CAA OMNIRANGE

4380 MILES OF AIRWAYS are now served by the CAA omnirange system. The first chain of ranges certified by the CAA covers Kansas, New Mexico, Nebraska, Texas, Colorado and Oklahoma. About three hundred ranges will be installed in all, and 1951 will find many changes in aeronautical radio operations and facilities. As the program develops Distance Measuring Equipment will be added to these installations and a complete system of instrument navigation with almost 100% reliability will result.

TV ABROAD

UNLESS THE WORLD SITUATION deteriorates, television may receive a much needed boost in Europe this year. A number of conferences were held during 1949 and 1950 in Europe to discuss the standards to be established. With the exception of Great Britain and France, most of the continental countries will standardize on 625 lines with a field repetition rate of fifty. Plans for coaxial cable and microwave connections are being made in many countries and the new standards should simplify interconnections.

APPROPRIATIONS

FCC FUNDS IN DANGER—The FCC is not expected to do so well in its quest for increased appropriations for the next fiscal year before Congress and this month (March) may tell the story of Congressional opposition towards the higher funds. General impression on Capitol Hill is that FCC has been taking too much time in lengthy hearings on educational television and in other broadcasting-television program policy studies and that these projects are somewhat in the "make-work" or "WPA-like" activities. In reality, all of the intensive review of educational television needs is felt meaningless because of the definite outlook of greatly reduced production of TV transmitters and studio equipment with the mobilization and defense shortages.

CO-CHANNEL

POLARIZATION MAY BE THE ANSWER to co-channel problems in TV—at least for microwave operations. Recent experiments reveal that by using one horizontally polarized, and one vertically polarized beam on the same channel, source discrimination can be effected by rotating the receiving antenna to the corresponding polarization. This method is useless for lower frequencies in the VHF band since it is impossible to control the wave-front path and tilt. But in cases where the beam effect makes it possible to ensure a smooth path the method appears to offer interesting possibilities. This system has sometimes been used in the past by TV field crews when only one frequency was available to do two jobs. Look for an extension of this principle in the television field.

BETTER TV SOUND

SOUND PERSPECTIVE to match the visual perspective has long been desirable in television. Cuts from a close-up to a medium shot too often have not given the viewer's ears the same impression that his eyes have. Now NBC has revealed data on an automatic audio coupling which provides a change of audio perspective with changes of camera shots and lenses. This is understood to be accomplished by switching equaliser networks coincidentally with the camera switcher. The method provides the decrease in frequency response so often associated with long and medium shots. As this type of operation spreads the long-neglected audio side of television will benefit by the greater realism produced.

NEXT MONTH—MAY

The Aeronautical Radio Issue of TELE-TECH, in connection with the Dayton National Conference on Airborne Electronics, May 23-25.

Minor repairs being made on parabolic radar antenna used by antiaircraft outfit with U. S. Third Army in Luxemburg.

Test Equipment

Specially conducted survey in 12 representative plants shows two major test systems being employed. Industry uses $6½ million worth of test instruments for TV receiver manufacture. Investment required for given daily productive output evaluated

Alignment test position at the Allen B. DuMont plant in East Paterson, N. J. Test signals (r-f and i-f) are derived via coaxial cable from central signal generator room. Fixed presence of picture tube (under protective metal and lucite cover) and fixed power supply makes for rapid testing

AT the conclusion of World War II when the Radio-TV industry converted for mass production of TV receivers, the amount and quality of test equipment required for this new operation seemed to offer an almost insurmountable problem both from a production and an economic standpoint. In fact, the consensus at that time indicated that this problem might eliminate many small scale receiver manufacturers from the market.

As the industry's 7-million set production for 1950 demonstrates, great forward strides have been made by TV receiver manufacturers — large and small—in making effective and economical use of test equipment both in production and the laboratory. In line with this development, TELE-TECH recently conducted a survey among a representative group of manufacturers to obtain specific information on the changes and current trends in test equipment which have made this great TV production possible—and to offer to industry the figures which indicate what types of equipment are being used, where they are being used, and what costs are involved.

The industry is today divided among proponents of centrally located signal generating systems (approximately 25% of manufacturers representing 30% of total TV receiver production); advocates of individual test set-ups (approximately 50% of manufacturers representing 55% of receiver production); and a middle group of manufacturers who locate at least a portion of their test equipment at a central point (25% representing 15% of total TV receiver production). All statistics referring to total TV production are projections from the sample surveyed, serving only as indications of trends in the industry.

Central Signal Generators

A complete central signal generating system might include the following equipment:

1. A Monoscope Chain—consisting of a monoscope camera, synchronizing signal generator, and a grating generator for checking linearity. Also one or more video distribution amplifiers, depending upon the number of test positions served, plus necessary coaxial leads and switching equipment.
2. I-F Sweep Generators and Pulse Markers — (both picture and FM sound), i-f distribution amplifiers, coaxial leads to the test positions served and switches.
3. R-F Sweep Signal Generator, and Pulse Markers—This setup would require 12 coaxial lines, coaxial switches at test positions, etc. Therefore many plants, otherwise fully equipped with centralized signal sources, use individual r-f sweep generators at test positions. For the purposes of the survey, such plants have nevertheless been included among those using complete central signal generating systems.
4. Television Transmitter, Amplifier and Master Antenna—Operating on either all 12 channels, or one high and one low band channel—may be modulated by the monoscope pattern or an off-the-air test pattern; usually includes an FM carrier, and can be used for a final test of the entire receiver chassis.

An advantage of the completely centralized system is that the signals throughout the plant are *theoretically* uniform, while maintenance and checking of the test equipment is at a minimum. (In practice the signals may not be so desirably uniform due to standing wave ratio.) When difficulties arise in the functioning of a centralized system, it should be noted that failure of even a portion of such a system may completely disrupt a production schedule.

The approximate cost of an initial central signal generating system (less distribution equipment) is $12,000 to $20,000. Distribution equipment costs amount to roughly $4,000 to $7,000 per 100 sets daily. The small scale manufacturer who uses a central system is therefore faced with a higher ratio of test equipment investment to receiver output, although this cost differen-

in TV Receiver Manufacture

SECOND OF A SERIES

tial is to some extent modified because expenses for distribution equipment—distribution amplifiers, coaxial cable, switches, termination boxes, etc.—are proportional to the number of test positions served. In addition, the very large scale manufacturer often invests in duplicates of much of his central signal generating equipment.

From plant to plant, the investment in test equipment may vary greatly for similar TV receiver production figures. At first glance this difference in cost figures might seem to be related to the type of test equipment used whether for centrally or locally generated signals. Closer examination of the subject usually shows that other factors such as company policies, individual engineering preferences, "inherited" equipment, etc. account for many of these cost variations.

The picture today, as in the entire TV field, is one of rapid change. Many manufacturers are using or plan to use at least a partially centralized test system, with a monoscope chain as a basis, because of the rapidity with which the test patterns are going off the air, due to increased programming hours by TV stations.

Production Line Set-Up

In the TV receiver plant, a central signal generating system can only serve to deliver to each test position the necessary signals which might otherwise be furnished by individual equipment at the test bench. (Indicating-devices such as vacuum tube voltmeters and oscilloscopes must be used at the test position whether the signal is generated locally or centrally.)

In a typical production line, the sequence of test positions might be: (1) yoke, synchronizing and deflection circuit operation check; (2) Tuning of i-f coils, picture and sound traps; (3) Completed check of i-f circuits for band pass, curve shapes, etc.; (4) r-f head alignment; (5) Final run-through of entire chassis including CR tube. The various signals required include: video signal, crystal-controlled i-f signals, i-f sweep and marker signals, r-f sweep and marker signals, a 4.5 Mc FM signal, and an r-f television signal.

Such a production set-up is out-

MANUFACTURER	A	B	C	D	E	F	G	H	I	J	K	L
Daily TV Receiver Output	100	100	150	150	200	200	650	750	1000	1000	1200	1200
Bridges, Capacity	3	1	1	3	3	5	3	3	6	10	1	4
Bridges, Impedance	2	1	1	1	2	2	2	1	2	3		
Bridges, Inductance	1	1		3	2	4	3	2	1	3		
Bridges, A-F, R-F & Misc.	2			4	4	2		1	8		1	3
Distortion Meters			2	1		2		1	1	5		1
Field Intensity Meters			1			1				2	1	
Noise Meters				1	1							1
Output Meters		1				2	4		4	5	2	
Oscilloscopes, Standard				2	12	5			11	10	7	
Oscilloscopes, Wide-Range	3	1	3	2	4			3	5	2	4	
Precision Power Supplies		1			3	2		4	11	5	3	1
Q-meters		1	4	3	3	2	8	3	5	3	2	2
Signal Generators, Audio	1	2	5	4	1	2	4	2	2	15	2	6
Signal Generators, AM (inc. TV)		1		1	15	10		8	8	8	5	
Signal Generators, FM		1			4	2			2	3	1	
Square Wave Generators	1		2	3			2	1	1	3	2	2
Sweep Generators				1	8	2		1	5	5	22	
Vacuum Tube Voltmeters	1	1	10	1	2	4		2	7	20	4	6
Volt-Ohmeters				3	15	5		18	7		6	
Miscellaneous Indicating Inst.	6	2	3	10	25	6	3	10	10	25	20	3
Total Value (approximate) of Equipment	$ 6,500	$ 4,000	$ 10,000	$ 17,000	$ 31,000	$ 13,000	$ 10,000	$ 22,000	$ 28,000	$ 40,000	$ 25,000	$ 10,000

Typical test equipment items used in TV receiver manufacturing plant laboratories, quality control, and incoming materials inspections

Typical test equipment items used in TV receiver production

MANUFACTURER	A	B	C	D	E	F	G	H	I	J	K	L
Daily TV Receiver Output	100	100	150	150	200	200	650	750	1000	1000	1200	1200
Distribution Amplifiers		1	4		21		15	73	27		90	
Grating Generators		1	1		1		1	2			2	
Marker Generators	6	4	5		2	10	25	18	84	10	5	100
Monoscopes		1	1		1		1	2	1	1	4	
Oscilloscopes	9	8	15	4	38	15	100	85	111	40	88	35
Output Meters			12	7	13	17			14	15	50	80
Power Supplies, Voltage Regulators, etc.	4	5	16	10	68	12	40	75	24	80	80	
Signal Generators, AM-FM-TV-Noise, etc.		8	21	12	68	40			13	90	8	150
SweepGenerators, R-F	3	4	3	2	17	2	26	26	81	50	2	14
Sweep Generators, I-F	3		5	3	4		21	4	4		2	50
Synchronizing Generators		1	1		1		1	2	1	1	3	
TV Signal Transmitters		1	1		2		2		2		5	
Vacuum Tube Voltmeters	13	2		27		8			1		16	6
Volt-Ohmeters	6	12	24	13	57	20	45	90	83	250	86	150
Approximate value of Test Installations	$ 14,000	$ 22,000	$ 44,000	$ 30,000	$ 82,000	$ 22,000	$ 92,000	$ 100,000	$ 100,000	$ 90,000	$ 230,000	$ 270,000

TV TEST EQUIPMENT (Continued)

lined in Table —, Comparison of Central Signal Generating System With Individual Test Set-Ups, representing a synthesis of the methods used in various plants rather than a typical example.

Since each manufacturer has devised testing procedures best suited to his own production requirements, actual techniques in the field vary widely. For instance, many manufacturers use a preliminary resistance "go—no go" check between selected circuit elements to assure against shorts and burn-outs due to soldering, lead dress, etc. when B+ is first applied. Others use an initial B+ or general voltage test as an effective method for inexpensively spotting defects in a chassis which might otherwise hold up the line in later trouble-shooting positions. Yoke tests, which often are performed first, may be introduced at another position, particularly if a test CR tube is used or if a separate mounting is employed for the CR tube.

Some manufacturers find it efficient to concentrate all tests involving sweep generators, either i-f or r-f, at one spot on the line. This procedure produces economies in personnel and test equipment, but may offer disadvantages in that too great a dependence is placed on the operators at these test positions, both as to the quality of the receivers and the total output of the plant. Should skilled technicians be unavailable for one reason or other, interchangeability with a lesser trained operator from another spot on the line will not always be feasible.

For similar reasons, some plants

(*Continued on page 76*)

COMPARISON OF MAJOR ELEMENTS IN CENTRAL AND LOCALLY GENERATED TV TEST SIGNAL SYSTEMS.

CENTRAL SIGNAL GENERATING SYSTEM		TESTS PERFORMED	LOCAL SIGNAL GENERATING SYSTEM
MONOSCOPE CHAIN . . . consists of monoscope camera, sync generator, and grating generator for checking linearity. Video distribution amplifiers, coaxial leads and switches for number of test positions served.	MONOSCOPE SIGNAL	**1. OPERATION of YOKE, SWEEP and DEFLECTION CIRCUITS.** Test Indicator: CR Tube	**MONOSCOPE PATTERN** . . . or special arrangement to provide video signal from broadcast pickup.
IF SWEEP and SIGNAL GENERATORS, PULSE MARKERS . . . for testing both picture and FM sound. Distribution amplifiers, coaxial leads and switches for number of test positions served.	IF SIGNALS	**2. PRELIMINARY I-F ALIGNMENT** Adjust stagger tuned i-f coils, picture and sound traps, FM discriminator. Test Indicator: VTVM	**MULTI-FREQUENCY or SEPARATE IF CRYSTAL CONTROLLED SIGNAL GENERATORS**
	IF SWEEP SIGNALS AND PULSE MARKERS	**3. COMPLETED I-F ALIGNMENT** (step 2 may be omitted, coils and traps may be adjusted with sweep oscillator) Band pass, curve shape, etc. Test Indicator: Oscilloscope	**IF SWEEP GENERATOR and PULSE MARKERS**
RF SWEEP SIGNAL GENERATORS and PULSE MARKERS . . . requires 12 coaxial lines.	RF SWEEP SIGNALS AND PULSE MARKERS	**4. RF HEAD ALIGNMENT** Test Indicator: Oscilloscope	**12 CHANNEL RF SWEEP GENERATOR with PULSE MARKERS**
TELEVISION TRANSMITTER, MASTER ANTENNA, AMPLIFIERS . . . TV transmitter may operate on all 12 channels or on one high and one low band channel . . . May be modulated by Monoscope or "Off-the-Air" test pattern . . . usually includes FM sound carrier.	"OFF-THE-AIR" SIGNAL OR MONOSCOPE PATTERN (RF)	**5. FINAL AIR CHECK** Test Indicator: CR Tube	**12 CHANNEL TV TRANSMITTER or "OFF-THE-AIR" SIGNAL**

JTAC COLOR TELEVISION SYSTEM COMPARISON TABLE

Tabulation of color TV characteristics and standards, prepared by Joint Technical Advisory Committee for FCC, presents details of competing systems

System	Horiz. Resolution Dots Per Line (5) (6)	Vert. Resolution Number Lines (6)	Product of H and V Resolutions	Frame Flicker		Interline or Interdot Flicker and Crawl (7)		Smoothness of Motion		Color Break-Up (8)	Receiver Changes Needed for Compatibility (12)		
				M	C	M	C	M	C		M (9)	C (10)	Comparison (11)
A1—6-MC Monochrome. 30 Frames. 60 Fields. Present Commercial System.	507	525	266×10^3	Equal	—	Equal	—	Equal	—	—	—	—	Equal
B1—12-MC Simultaneous Color. 30 Color Pictures. 60 Fields. (1) G=4MC; R=1.8 MC; B=1.4 MC. Like system demonstrated by RCA in 1947. "Mixed Highs" employed.	G 507 B 507 R 507 M 507 (25)	G 525 B 525 R 525 M 525	G 266 B 266 R 266 M 266	Equal	Equal	Equal	Equal	Equal	Equal	No	None	N. F.	Equal (13)
C1—12-MC Field Sequential Color. 24 Color Pictures. 144 Fields. Like system demonstrated by CBS in 1947.	C 528 M 528	C 525 M 525	C 277 M 277	Inf.	Inf.	Equal	Equal	Sup.	Inf.	Yes	N. F.	N. F.	N. A.
C2—6-MC Field Sequential Color. 24 Color Pictures. 144 Fields. Like system demonstrated by CBS in 1949-50	C 275 M 275	C 405 M 405	C 111 M 111	Inf.	Inf.	Equal	Equal	Sup.	Inf.	Yes	a–d	a–c and f–h	Inf. (14)
C2A—6-MC Field Sequental Color. Dot and Line Interlaced. 12 Color Pictures. 144 Fields. Like system demonstrated by CBS to FCC on April 26, 1950.	C 550 M 550(15)(26)	C 405 M 405	C 222 M 222 (15)	Inf.	Inf. (16)	Equal (17)	Equal (17)	Sup.	(18)	(19)	a–d (20)	a–c and f–h	Inf.
C3—6-MC Field Sequential Color. 20 Color Pictures. 240 Fields. (2) Dot and Line Interlaced.	C 420 M 420	C 315 M 315	C 132 M 132	Sup.	Sup.	Equal	Equal	Sup.	Equal	Yes	a–e	a–c and f–h	Inf.
D1—6-MC Line Sequential Color. 30 Color Pictures. 60 Fields. Simple Interlace. Alternate odd lines R, G, B, then alternate even lines R, G, B.	G 507 B 507 R 507 M 507	G 175 B 175 R 175 M 175-525	G 89 B 89 R 89 M 89-266	Equal	Equal	Inf.	Inf.	Equal	Equal	No	None	i	Inf.
D2—6-MC Line Sequential Color. 30 Color Pictures. 60 Fields. Non-interlaced. (3) First Field G, R, G, R, then Second Field G, B, G, B.	C 504 M 504	G 264 R 132 B 132 M 264	G 133 R 67 B 67 M 133	Equal	Inf.	Equal	Inf.	Equal	Inf.	No	None	i	Inf.
D3—6-MC Line Sequential Color. 10 Color Pictures. 60 Fields. Simple Interlace Plus Color Line Commutation. Under development by Color Television, Inc. in 1949-50.	C 507 M 507	C 525 M 525	C 266 M 266	Equal	Equal	Inf.	Inf.	Inf.	Inf.	No	None	i	Inf.
D3A—6-MC Line Sequential Color Line Interlaced with Color Commutation. 10 Color Pictures. 60 Fields. Like system demonstrated by CTI to FCC on May 17, 1950.	C 507 M 507	C 525 M 525	C 266 M 266	Equal	Equal	Inf.	Inf.	Inf.	Inf.	No	None	i	Inf.
E1—6-MC Dot Sequential Color. 15 Color Pictures. 60 Fields. (4) Dot and Line Interlaced. (3) Line Sequence G, R, G, B.	G 254 R 254 B 254 M 254-507 (26)	G 525 R 262 B 262 M 262-525	G 133 R 67 B 67 M 67-266	Equal	Equal	Equal	Inf.	Equal	Equal	No	None	i	Inf.
E2—6-MC Dot Sequential Color. Dot and Line Interlaced. 15 Color Pictures. 60 Fields. "Mixed Highs" like system demonstrated by RCA in 1949-50.	G 507 B 507 R 507 M 507 (25)(26)	G 525 B 525 R 525 M 525	G 266 B 266 R 266 M 266	Equal	Equal	Equal (17)	Equal (17)	Equal	Equal	No	None	(21)	(22)
F1—6-MC Frequency-Interlace Color. 30 Color Pictures. 60 Fields. Standard Line Interlace "Mixed Highs" under development by G.E. Co.	G 507 B 507 R 507 M 507(25)(26)	G 525 B 525 R 525 M 525	G 266 B 266 R 266 M 266	Equal	Equal	Equal	Equal	Equal	Equal	No	None	(23)	(24)

LEGEND: M—MONOCHROME (BLACK & WHITE)
C—COLOR
G—GREEN
B—BLUE
R—RED
INF.—INFERIOR
SUP.—SUPERIOR
N. F.—NOT FEASIBLE
N. A.—NOT APPLICABLE

(1) Committee agrees that optimum performance requires less bandwidth for blue and red channel than for green channel. The numbers shown were suggested by RCA.

(2) Interlaced in both directions. Vertically in the usual fashion, horizontally by pulsing the video signal with an 8-mc dot carrier.

(3) Suitable correction is applied for the excess of green.

(4) The video signal is pulsed with an 8-mc dot carrier and the colors are changed at both line and dotting frequencies.

(5) A picture dot is a half cycle of the top frequency of the nominal video band. For example, in present commercial transmission, with a nominal video band of 4 megacycles a picture dot lasts 1/8 microsecond. A scanning line lasts 63.4 microseconds. Hence, the number of picture dots per line is 507.

(6) Blanking times are ignored throughout, because figures are not available for some of the systems.

(7) It is assumed that brightness and viewing distance are such that there is no frame flicker and the scanning lines are just not resolved. It was agreed that for the systems considered, susceptibility to flicker and crawl are not appreciably different. In some different systems, susceptibility to small-area flicker may be different from that to interline crawl. For system D1, there will be an increased tendency for interline flicker because of the assignment of a specific line to a specific color.

(8) In systems C1, C2 and C3, longer persistence phosphors, as used in the all-electronic receiver, have almost eliminated color break-up.

(9) To allow present receivers to receive color transmissions in monochrome.

(Continued on page 93)

DEFENSE CONTRACTS —

How to Sell to the Signal Corps

By Lt. Col. STANLEY GERSTIN
Manager, Government Manuals Division,
Caldwell-Clements, Inc., New York City

Dollar value of radio-communication-electronic equipment to be purchased by the Signal Corps during 1951, originally estimated at $300 million, is now likely to go as high as $500 million.

Bulk of this business has been going to a limited number of major manufacturers, although with greater diversification than is the case with the Navy and Air Force.

Top-level efforts to spread contracts throughout radio industry has lately resulted in a more equitable distribution of military equipment awards.

Fact remains that Signal Corps requirements are still too small to provide enough defense work for all radio industry manufacturers. Vast production capacity and restricted civilian output mean idle machines and manpower and pose serious financial problems.

Exhaustive inquiries by TELE-TECH in Washington, Philadelphia, Ft. Monmouth, Chicago and New York procurement centers reveal latest procurement data and what manufacturers should do to get defense business.

THE SHIFT IN MILITARY requirements and planning has resulted in a parallel shift in the requirements for radio-communication-electronic equipment from the Signal Corps to the Navy and Air Force. However, in 1951 the Signal Corps will buy an estimated $300 to $500 million worth of radio-electronic equipment, and the question of who gets this business continues to hold the radio industry off balance.

How to get this business is still the $64 question among hundreds of radio product, component and parts manufacturers.

Here are the facts. Here are the names of places to go and people to see. Here is the information about who buys what, when and where. It answers the questions:

Who gets negotiated contracts?
Who is invited to bid?
Who gets the business?
What are YOUR chances of getting defense contracts as a prime contractor? As a subcontractor?

The following information is factual, specific, realistic. It is designed to help manufacturers avoid going to the wrong places, seeing the wrong people, furnishing the wrong information about themselves.

First, some general information.

Manufacturers should not be confused by the several "Industry" boards and committees charged with making studies of industry plants, capacities, facilities, etc. Plant allocation surveys being conducted by the Munitions Board, for one, the Small Business surveys for another, have no bearing on immediate prospects of a manufacturer getting a defense contract. Your plant might even have a mobilization assignment but it doesn't mean that you will automatically get a war contract. You still have to compete for defense business.

Despite the fact that manufacturers are advised that they can register for defense contracts and need no sales organization to obtain defense business, it is advisable and highly desirable that manufacturers or their representatives personally visit every procurement office to discuss their facilities and ability to make specific products with both the engineering and contracting personnel.

Since military and civilian engineering and procurement personnel are people trying to do a job, their time is limited and, consequently, they are not always easy to see. However, it is not necessary to run around in circles or wait long hours in hotels or haunt reception rooms. The simple expedient of making a timely appointment, by telephone, may result in a satisfactory interview with an engineer or a contracting officer, and for this purpose the Signal Corps maintains a Bidders' Information office where a manufacturer can get a hearing and be directed to the right people. The Signal Corps Procurement Chart opposite furnishes specific data on this point.

A Small Business Advisory func-

(*Continued on page* 85)

WHERE TO SELL RADIO, RADAR, AUDIO, WIRE COMMUNICATIONS, ELECTRONIC EQUIPMENT, COMPONENTS, TEST and POWER EQUIPMENT for DEFENSE

SIGNAL CORPS PROCUREMENT AGENCY

2800 S. 20th STREET, PHILADELPHIA 45, PA., HOWARD 5-2000

COL. W. D. DILLINGER, Commanding

LT. COL. L. R. KLEINKNIGHT, Deputy Ext. 202

TECHNICAL STAFF OFFICE

LT. COL. W. E. JENNINGS

(ADVISES CO ON TECHNICAL, PUBLIC MATTERS)

LT. COL. E. L. P. MUELLER

Ext. 314

(CONSULTS WITH SMALL BUSINESS; ADVISES ON SigC REQUIREMENTS)

LABORATORY OFFICE

Ft. Monmouth, N. J. Eatontown 3-1060

LT. COL. ROBT. F. HAFFA Ext. 2862

PERFORMS ALL FUNCTIONS INCIDENT TO SOLICITATION, AWARD AND ADMINISTRATION OF RESEARCH & DEVELOPMENT CONTRACTS FOR SIGNAL CORPS ENGINEERING LABORATORIES

SIGNAL CORPS ENGINEERING LABORATORIES

Ft. Monmouth, N.J. Eatontown 3-1060

Maj. Gen. H. Reichelderfer

DETERMINES REQUIREMENTS FOR RESEARCH & DEVELOPMENT OF TEST MODELS ONLY

SQUIER SIGNAL LABORATORY

Ft. Monmouth, N. J. Eatontown 3-1060

LT. COL. W. M. YOUNG

DETERMINES REQUIREMENTS FOR COMPONENTS AND POWER SUPPLIES

COLES SIGNAL LABORATORY

Red Bank, N. J. Eatontown 3-1060

COL. R. E. H. MEYER

DETERMINES REQUIREMENTS FOR RADIO, WIRE COMMUNICATIONS, GENERAL ENGINEERING

EVANS SIGNAL LABORATORY

Belmar, N. J. Asbury Park 2-7440

COL. B. STERN

DETERMINES REQUIREMENTS FOR RADAR, METEOROLOGICAL EQUIPMENT

REGIONAL OFFICES

ADMINISTERS CONTRACTS WITH MANUFACTURERS IN RESPECTIVE AREAS; OCCASIONAL LIMITED PROCUREMENT AT REQUEST OF PHILADELPHIA SIGNAL CORPS PROCUREMENT AGENCY

CHICAGO REGIONAL OFFICE

22 W. Jackson St., Chicago, Ill.

Andover 3-3600

LT. COL. R. M. LOCKHART

JOHN E. NYLIN, Civ. Ass't.

NEW YORK REGIONAL OFFICE

80 Lafayette Street, N.Y.C.

WOrth 4-7300

LT. COL. E. P. BOYNTON Ext. 480

A. Long, Civ. Ass't. Ext. 481

CONTRACTING DIVISION

LT. COL. W. B. FEINDEL, JR., Chief Ext. 668

J. W. ROBINSON, Civilian Chief Ext. 293

AWARDS AND ADMINISTERS SIGNAL CORPS CONTRACTS FOR COMMUNICATION EQUIPMENT ON ADVERTISED AND NEGOTIATED BASIS

SERVICE BRANCH

MAJ. L. E. BROOKHART

Ext. 374

BIDDERS' INFORMATION SECTION

C. CHANAKO Ext. 382

(Mfrs. must see on initial call by appointment)

INTERVIEWS MANUFACTURERS, DEVELOPS AND PROVIDES LISTS OF PROSPECTIVE BIDDERS

EQUIPMENT BRANCH

LT. COL. T. W. PARSONS

Ext. 243

END ITEMS: PREPARES BIDS, MAKES AWARDS

COMPONENT BRANCH

LT. COL. J. L. SMITH Ext. 181

COMPONENTS: PREPARES BIDS, MAKES AWARDS

COMMODITY SECTION 01

CAPT. R. L. PORTER

Ext. 466

AWARDS AND ADMINISTERS CONTRACTS FOR RADIO AND METEOROLOGICAL EQUIPMENT

COMMODITY SECTION 02

MAJ. H. F. CLEARY

Ext. 337

AWARDS AND ADMINISTERS CONTRACTS FOR RADAR AND AUDIO EQUIPMENT

COMMODITY SECTION 03

CAPT. G. M. FOWLER

Ext. 244

AWARDS AND ADMINISTERS CONTRACTS FOR WIRE COMMUNICATION EQUIPMENT

COMMODITY SECTION 04

LT. COL. C. J. YOHE

Ext. 187

AWARDS AND ADMINISTERS CONTRACTS FOR TEST EQUIPMENT (also selected photo items)

COMMODITY SECTION 11

CAPT. T. P. COOPER

Ext. 146

AWARDS AND ADMINISTERS CONTRACTS FOR POWER EQUIPMENT (dynamometers, converters)

COMMODITY SECTION 12

MAJ. J. H. WOOTEN

Ext. 171

AWARDS AND ADMINISTERS CONTRACTS FOR HARDWARE AND TOOLS

COMMODITY SECTION 13

CAPT. P. F. DAVIS

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AWARDS AND ADMINISTERS CONTRACTS FOR ELECTRONIC CIRCUIT ELEMENTS

COMMODITY SECTION 14

LT. COL. P. S. BALAS

Ext. 346

AWARDS AND ADMINISTERS CONTRACTS FOR MISCELLANEOUS ELECTRONIC COMPONENTS

COMMODITY SECTION 15

LT. COL. R. I. ULANS

Ext. 319

AWARDS AND ADMINISTERS CONTRACTS FOR ELECTRICAL AND LINE SUPPLIES

Radio's

By JOHN H. BATTISON
Associate Editor

Fig. 1: Motorola Handie-Talkie used in air raid test in Chicago while civilian defense officials and metropolitan and suburban fire chiefs observe emergency operations

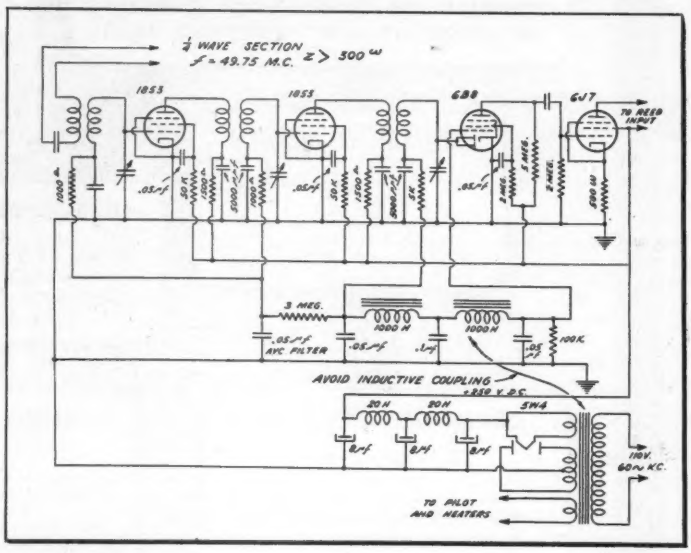


Fig. 2: VHF, TRF receiver unit for operation on 50 MC. This was early model of TV "alerter" for unscheduled events

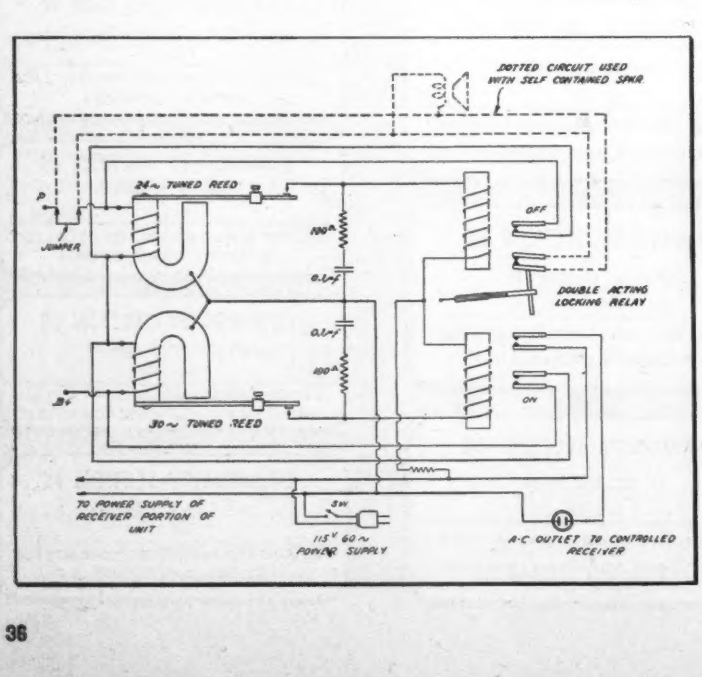


Fig. 3: Circuit of the coded operator unit which responds to low frequency audio modulation only

RADIO and television are destined to play a very large part in the safeguarding of life and property in the United States for a considerable time. In fact, the present emergency may actually produce some beneficial results in accelerating the modification of our broadcast system to provide a source of real mass communication. For a long time radio has been regarded solely as a means of entertainment and its most important asset—that of making possible instantaneous communication to the whole nation *en masse* by means of a loudspeaker has been sadly neglected. The prospect of a telephone exchange ringing all its subscribers to alert them for a special message is somewhat disconcerting, but alerting all, or specific, listeners in the service area of a station by a single code transmission would be the simplest thing in the world.

Television's role in defense appears to be limited to teaching the public what to do in emergency—*before the event*—and possibly showing specific personal actions required after it, if there are any television stations still operating and there is electric power available to energize TV receivers. Of course, remote pickups from field equipment would be invaluable in showing the *true* extent of damage, and building public morale by allaying false rumors of catastrophic destruction. But it is upon radio and the coded and spoken word that the real load would fall.

There are three main categories into which the radio alerting and message signalling systems fall.

National: Because of the size of the United States, it is unlikely that the whole country would require alerting for spasmodic enemy action. However, if invasion from the air were expected every area might be alerted to watch for it, or for saboteurs, etc. Special government messages and proclamations also would require this nationwide hookup. But it seems more probable that most emergencies would be of regional or local proportions.

Regional: Individual states might require to proclaim emergencies and mobilize militia, or declare whole areas unsafe, etc. Here a regional signalling system could be provided, delineated according to defence regions, state

Job in Civil Defense

Emergency and warning services provided by radio and TV in roles of coded alert transmissions and plain language messages. Manufacturers demonstrate equipment.

boundaries, or both. Selective calling to the services required, and the organizations to be alerted, would be accomplished by transmission of the code signal over landlines or radio stations; the latter would probably be more reliable since landlines can easily be sabotaged. The units to be called would have battery powered receivers, and thus be independent of any external sources of power or physical line connection.

Local: This category includes cities and surrounding areas. There may be twenty-seven broadcasting stations or there may be only one in a city. But, by connection to each one from the master civilian defence control room, it would be possible to transmit the desired alerting code without even the radio station personnel knowing about it. Here, the stations would be used to warn local public services, such as: fire, police, ambulance, hospitals, etc., to stand by. Also the three degrees of warning, YELLOW, RED, AND WHITE, can be transmitted to such organizations without continually alarming the population by frequent YELLOW warnings.

Mobile Services

The number of public service radio networks is increasing all the time and involves use of mobile phone equipment. Already many medium and large cities (as well as some small ones[1]) have installed VHF and HF mobile phone systems for their municipal services.

In addition to the more obvious use by such local city departments, forestry service reports will be invaluable in densely wooded areas in case of firebomb attacks. The industrial and taxi services will provide mobile addditional units for communication points, and the local coordinator can assign these mobile stations to damaged, or cut-off areas to be used for calling for emergency services required there.

The plans of the civilian defense organization obviously should not be laid bare, but the equipment to provide the various coded signals exists and is out of the drawing board stage. In fact, very little development work remains to be done. As long ago as 1941 RCA demonstrated a civilian warning receiver based on the use of sub-audible frequencies.

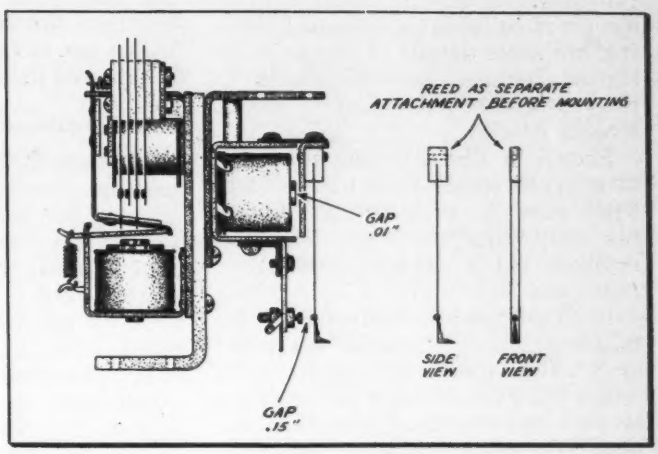


Fig. 4: Frequency sensitive relay showing construction and reed tuning

This is a simple receiver, and employs common and easily obtainable parts. Refinements are expected in the product design stage, and these will probably take the form of improved selectivity in the frequency selective relays to provide more channels in the available range of frequencies.

The most pressing job to be done now is the decision by the Office of Civilian Defense regarding which frequencies are to be assigned to specific services and whether these are to be national, regional or local.

When television was in its infancy its developers foresaw a need for an automatic device to call viewers' attention to special unscheduled events, since it was not considered practical to keep a thirty tube television receiver running continuously in the hope of some unscheduled event happening. A simple unit, consisting of a TRF tuner, was developed, designed to run continuously. If a special telecast occurred the unit would intercept a code signal and switch

Fig. 5: General Electric officials demonstrate two-way radio for civil defense. Left to right, Neal F. Harmon, G. E. civil defense sales coordinator, L. W. Goostree, Robert R. Burton, communications head for Federal Civil Defense Administration, Paul L. Chamberlain, Ellis M. Trefethen, and Roy D. Jordan, G. E. defense committee

on the television receiver, at the same time ringing a bell, lighting a lamp, or in some other way signalling that the viewer should attend his TV receiver.

Pending decisions by the officials concerned, final designs have not been completed; however, the work already done during World War II provides excellent material for the design of suitable equipment. Following are some details of the RCA designed Defense Receiver based on the original television "Special Events Alerter."

Shown in Fig. 2 is the schematic diagram of the original RCA 50 MC. TRF receiver with output circuits for controlling the main television receiver via a frequency sensitive reed relay.

In Fig. 3 are shown the circuit details of the code activated "operator" unit. This unit will operate with either the TRF 50 MCV HF receiver, or with the broadcast frequency receiver shown in Fig. 6. In each case a field intensity of 5 mv/m modulated 5% will operate the relays. It will be noticed that in the 50 mc special receiver tubes of high heater consumption and cost are used, whereas in the broadcast receiver ordinary low cost receiving tubes are used which reduce operating and production costs. By using modern miniature tubes in the VHF receiver, and modifying the design, more than one tube function could be combined inside one envelope, and similar savings would be obtained.

Use Broadcast Band

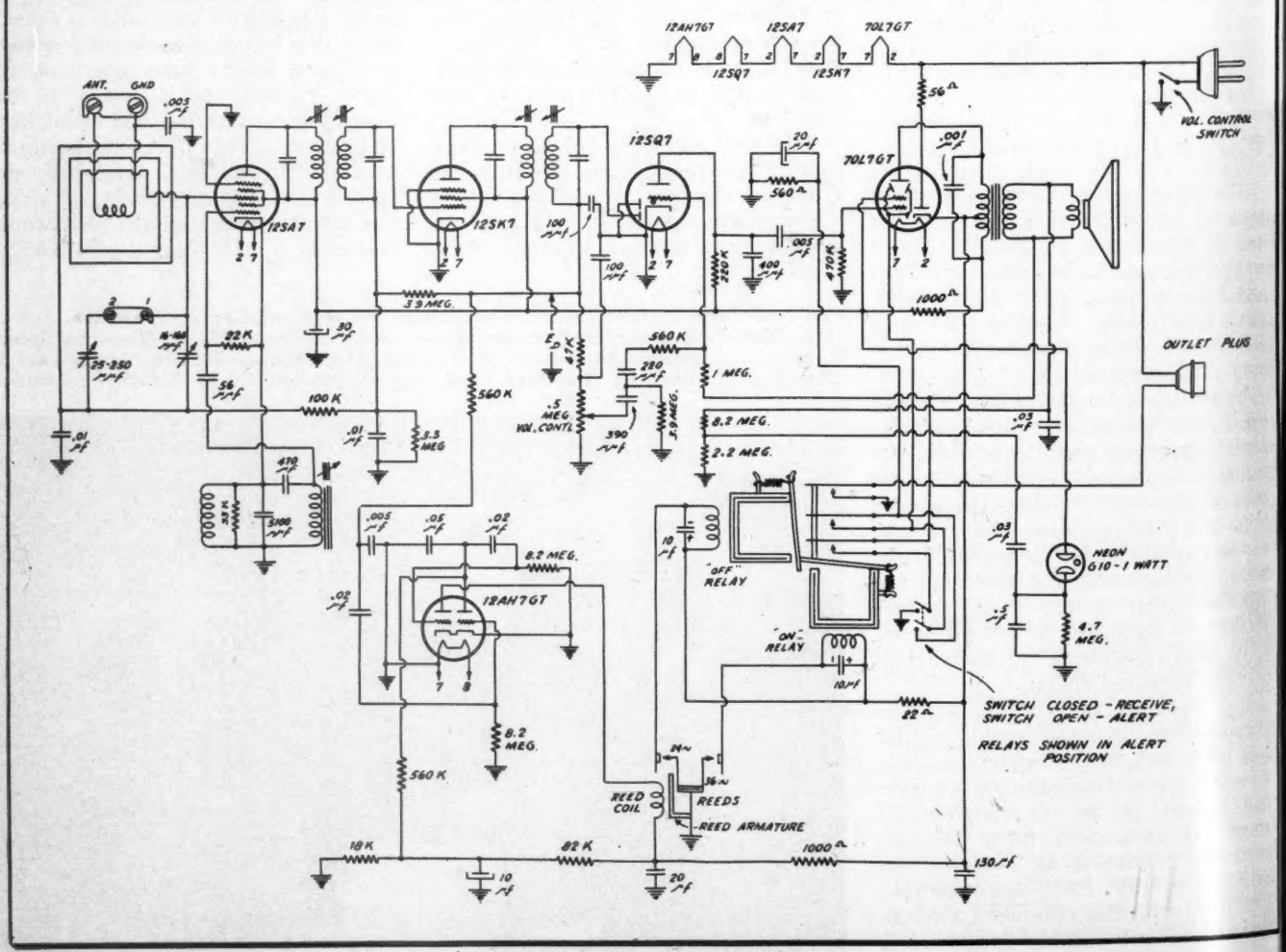
It seems more than likely that the medium frequency broadcast band will be used for defense communication rather than VHF, since television as such will not require to be alerted. But in view of the high degree of television viewing in some cities, it might be advisable to provide certain key personnel with VHF attachments for their TV receivers so that they could be alerted, even if they were using TV and not radio at the time of an emergency.

The main purpose for which the units are designed is to provide a coded calling system which, through the medium of a continuously "alive" receiver, will make it possible to communicate with selected group(s) of defense personnel. The receiver circuit shown in Fig. 6 is tunable to any frequency in the broadcast band by means of a preset control. It is probable that all broadcast stations in the area would be connected to the central defense control board so that they would all transmit the same code groups at the same instant.

Although the original simple circuits operated with a fair degree of reliability, they were subject to erratic operation caused by random noise at the carrier frequency and occasional extra low frequency modulation. Therefore, a noise limiter was built into the broadcast band unit. This consists of a 12 AH 7 GT stage so arranged that double limiting occurs in the form of plate current cutoff, and output voltage limiting. The output is entirely adequate to operate the frequency selective relay but is much higher than any

(*Continued on page* 68)

Fig. 6: Circuit diagram of the broadcast-band super-het. unit with preset tuning, 12AH7 noise discriminator stage, and "Receive-Alert" switch to mute speaker when required by reception of a coded signal. Reeds for 24 and 36 cps are shown



Conservation of Critical Raw Materials

RCA and Philco describe design changes to effect "savings" in TV receiver manufacture

FOR the good of the television receiver industry let us drop the name "AUSTERITY" model and use "CONSERVATION" model to designate television receivers in which a reduction in critical raw materials has been made but in which there has been no curtailment of performance.

RCA's Program

RCA, in presenting its conservation program to the industry, has issued an interesting and informative booklet through its Industry Service Laboratory entitled "Conservation of Critical Materials." In this booklet, using a 17-in. model as a basis, the following tabulation summarizes the savings in present production sets against those anticipated when electrostatically focused tubes are employed. Figures are for one million sets:

Material	Pounds saved/ million sets, Present Production	Pounds saved/ million sets, Electrostatic-focus tube
Alnico V Speaker Based on 2.15 oz. magnet in 8 in. speaker	72,000	72,000
Alnico V Speaker Based on 3.16 oz. magnet in 12 in. speaker	135,000	135,000
Alnico V Focus Magnet Based on 5 oz. magnets	.....	310,000
Alnico V Beam Bender	4,400	4,400
Steel in 12 in. Speaker	142,000	142,000
Brass in 12 in. Speaker	50,000	50,000
Zinc in Focus Magnet	.....	310,000
Steel in Focus Magnet	.....	500,000
Brass in Focus Magnet	.....	22,000
Aluminum-Cup Over Back of Kinescope	62,000	62,000
Brass in Volume Controls	12,200	12,200
Copper-Shorting Band in Power Transformer	190,000	190,000
Copper Hook-up Wire	47,000	47,000
Copper-Leads on Paper and Ceramic Capacitors	11,850	11,850
Aluminum Shield	100,000	100,000

In addition, the following metal savings are in effect in the manufacture of tubes and ferrite magnetic cores used in the manufacture of one million TV receivers, 23 tube TV receiver used as basis:

Material	TV Savings lbs./million/receivers
Nickel	
(a) Nickel content in ferrite cores	12,400
(b) Nickel in receiving tubes and kinescopes	33,600
Copper in receiving tubes and kinescopes	33,000
Tin content in solder	50

Other more important conservation steps that have been taken are: The average receiver contained about 7.5 oz. of Alnico V of which 2.5 oz. is used in the loudspeaker and 5 oz. in the focus magnet. Alnico V is composed of 24% cobalt, 14% nickel, 8% aluminum, 3% copper and 51% iron. In order to reduce or eliminate the use of cobalt, the size of the loudspeaker magnet has been reduced to 0.75-1 oz. If cobalt continues in critical short supply it then may become necessary to return to electromag-

(*Continued on page* 72)

Chart graphically portrays critical metal savings in new Philco TV receiver designs. Parts mounted on the left side of each of the five columns are used in present designs. New receiver parts using much less metal are shown on the right.

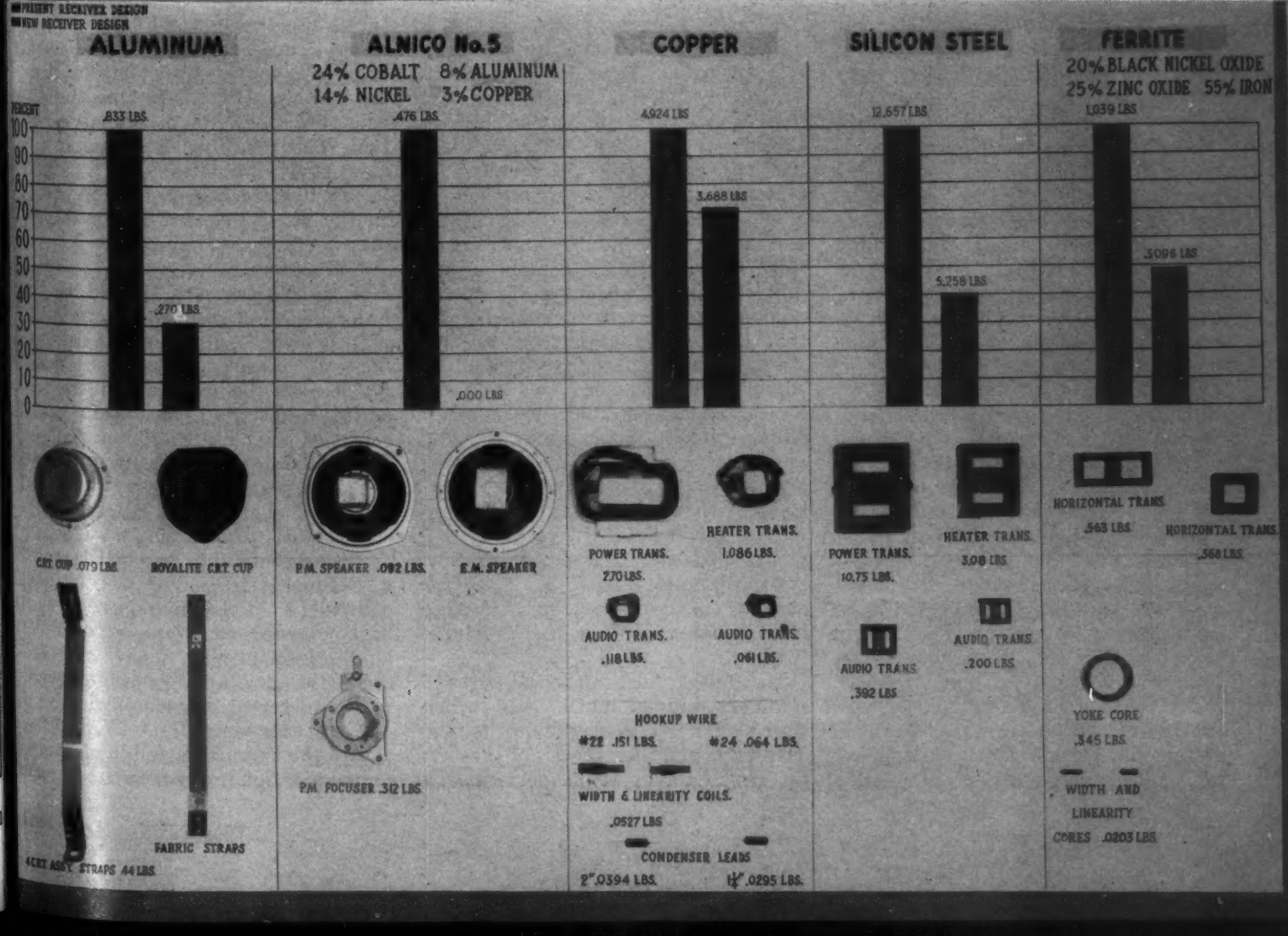


Fig. 1: Western Union microwave relay tower located in Washington, D. C.

Modern Telegraphic

FM carrier transmission, factors in providing speed

By IVAN S. COGGESHALL, *General Traffic Manager, International Communications Dept., Western Union Telegraph Co., President of Institute of Radio Engineers, 1951*

and ALBERT E. FROST, *Assistant Equipment Research Engineer, Development and Research Dept., Western Union Telegraph Co., 60 Hudson St., New York City*

AS in every other type of public utility from broadcasting to power distribution, the vacuum tube has become the wheel horse of progress in the telegraph industry; and, as in those parallel applications, its period of adaptation dates from the middle 1920s. At that time, telegraph technology, having already sloughed off the shackles which bound it to dot-dash Morse operation, was assuming the shiny new harness of the time-division multiplex and its mark-space techniques. Along came new radio techniques in the form of a-c frequency expansion and subdivision of the wire transmission spectrum—and, teamed in double harness with the telegraph printer and reperforator, they have carried the burden of telegraph and submarine cable achievement for 25 years.

Creation of an inter-city microwave radio relay system, a nationwide FM carrier telegraph network, and a system of interconnected major switching offices throughout the country, are some of the goals already reached in the process of virtual rejuvenation of the telegraph system since the Western Union-Postal Telegraph merger of 1943. Thrown in for good measure has been the development of facsimile as a valuable adjunct to printing telegraphy in speeding the pick-up and delivery of telegrams—one striking feature being the facsimile-equipped radio "Telecars" which now roam Baltimore's streets to test efficiency and public acceptance. The submerged amplifier for transatlantic cables, powered from shore, rounds out a picture of engineering experimentation which in a single company runs the gamut of spectrum width, from frequencies lower than a cycle per second, important to the proper shaping of cable signals, to 10,000 mc on the experimental radio beam.

Electric telegraphy was born of a crying need for instantaneous communication at a distance and a concurrent intellectual appreciation of the usefulness of voltaic electricity to achieve that end. Telegraphy was the first large scale commercial application of man's increasing knowledge of phenomena with which he had toyed for hundreds of years. Born so early in the history of applied electricity, perhaps it was on account of age and ingrained habit that the telegraph industry seemed slow, to impatient souls, in adopting the new tools provided by Pupin and de Forest. Simple audio-frequency ac and amplification, however, did not supply an answer to problems plaguing the telegraph engineer. Even if they had, the telegraph frequency spectrum with essential components approaching zero frequency, and prerequisite reliability were far outside the realm of radio developments during the teens of this century.

In landline telegraphy the key and sounder reigned until 1915 when they began to give ground to the multiplex printing telegraph system for long haul or trunk service. In the twenties the start-stop teleprinter made its appearance in short haul service where it at first supplemented and later has almost supplanted the multiplex.

Submarine Cables

Concerted effort culminating in the adoption of vacuum tube techniques in the telegraph industry was first directed to submarine cables. Feeble signals received from a transoceanic cable taxed the ingenuity of engineers to produce sufficiently sensitive electro-mechanical responsive devices to translate the wandering weaklings into an intelligible form. Electronic amplifiers changed this picture, making it possible to employ energy-sapping, signal-shaping networks, thus effecting tremendous improvement in signal definition. The resulting microscopic but more stable signal could be amplified to any desired degree for the operation of rugged electro-mechanical devices.

Signaling speeds of early transatlantic cables were limited to the order of 6 to 8 cps. Advances in the principles of loading and the development of suitable magnetic materials resulted in the first loaded transatlantic cable in 1924. This cable, equipped with signal shaping amplifiers, operates at a frequency of 65 cps, distributed among five printing telegraph channels. A second loaded cable, laid in 1926, has a signaling frequency of 100 cps utilized by 8 channel time division multiplex equipment. This cable operates at a higher speed than those found in landline telegraphy today, and exceeds the capability of conventional relays to repeat signals efficiently.

About this time Dr. A. W. Hull invented the thyratron, and in electrical communication it was first put to work

Communication Systems

microwave radio relay and facsimile are important ier service and increased traffic handling capacity

Ivan S. Coggeshall
President, Institute of Radio Engineers, 1951

on submarine cables. Circuits were developed for using this new tool instead of relays to interpret high speed signals and also for phase correction of multiplex distributors. In a high speed telegraph system the absence of contact travel time, bounce, and characteristic distortion are important advantages of the thyratrons over relays.

The performance of thyratrons on ocean cable equipment fully justifies their use at speeds above 70 to 80 cps where their superiority over relays becomes marked. Over a period of more than 15 years, they have demonstrated that they have long life, require no maintenance, and that failures are rare. During this extended period they have made it possible to operate an overseas circuit at 400 words per minute, 24 hours each day, month in and month out, stable enough to carry the most exacting forms of teleprinter operations, including the reperforator system, cipher equipment, and the varioplex. The cable to which the thyratron equipment is connected is the fastest and most reliable single line of telegraph of any kind now spanning the Atlantic.

Company's War Record

Probably the finest compliment which the Western Union cable engineers could receive came upon the entry of the United States into World War II, when they were called upon to provide terminal and repeating amplifiers and other equipment for cables in various parts of the world, so that these cables could be converted to multiplex printer operation. These cables included the Army's Alaska Cable System and the Commercial Cable Company's transatlantic cables. Signal shaping amplifiers were also supplied to the Commercial Pacific Cable Company and for the British Pacific Cables, but these long cables still employ cable code.

Lessons learned from experience in dealing with frequency analysis and filter design in the cable system began to be applied to the landlines in 1926, in the form of carrier operation over transposed metallic pairs. Progress was stimulated in 1937 with the adoption of FM in place of amplitude modulation. In contrast with carrier telegraph systems of other major record communications companies, Western Union stands alone in employing frequency modulation in its vast network. Excellent spectrum economy is realized as well as more freedom from noise and bias. Experience with thousands of FM telegraph channels has demonstrated their reliability and flexibility. While the relative merits of AM and FM methods for various conditions of operation have been the subject of study for years, Western Union has adopted FM for its nearly two million miles of such circuits.

Voice frequency bands, either those derived from Western Union carrier systems for wire line and radio relay systems or those leased from A.T.&T. and the associated companies, have a bandwidth of approximately 3000 cps. It has been found expedient to subdivide such bands into two subbands and to operate 8 or 9 telegraph channels in each subband. To provide maximum flexibility with minimum

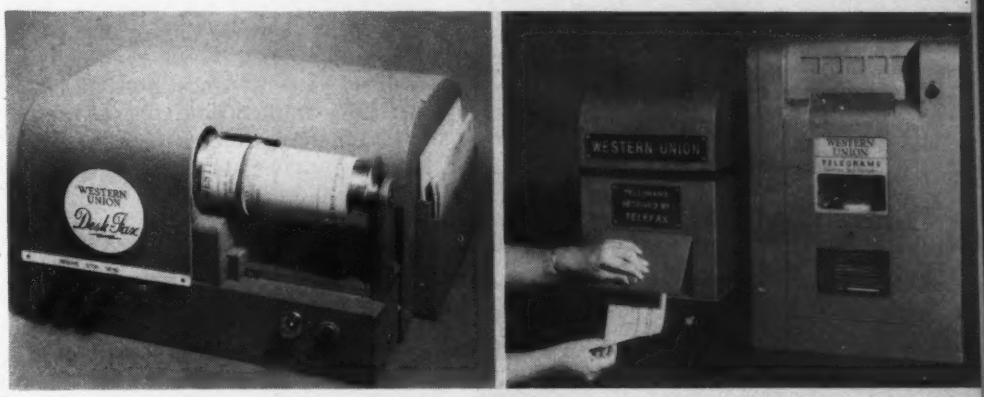


Fig. 2: (Left) Modern Desk-Fax Transceiver for substation or patron offices may ultimately replace telegraph printers (Right) Telefax receiver and Auto-Fax transmitter for semi-public locations. Note resemblance of latter to mail postbox

Fig. 3: (Left) Telecar in Baltimore is outfitted with facsimile machine which continuously picks messages for delivery off the air. (Right) Interior view of Telecar shows l. to r. 35 Mc receiver, power supply, relay control panel, and recording amplifier. Answers to telegrams are radio-telephoned to central station for retransmission

TELEGRAPHIC COMMUNICATION (Continued)

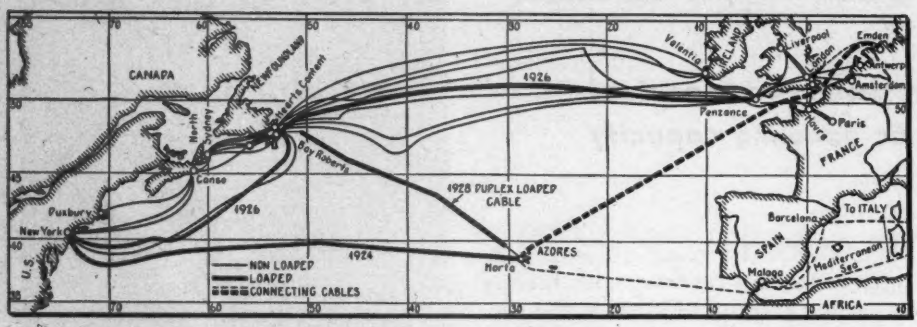


Fig. 4: Subarine telegraph cable routes and connection points between Europe and North America. Cable between Emden and Azores was severed during World War II near Le Havre and, after use by U. S. Forces, is now in service for civilian traffic.

Fig. 5: Telefax concentrator for 100 lines.

Fig. 6: Carrier terminal equipment in N.Y.C.

variety in the types of equipment required, the carrier equipment is built up of standard units arranged to meet various conditions. The telegraph channel terminals are normally assembled in groups of 8. These terminal sets are wholly electronic, the outgoing carrier being frequency modulated by the telegraph printer or other transmitting machine, and the incoming carrier being detected and amplified to a power level sufficient to drive the printer on the receiving side. Designed specifically for single channel teleprinter service, they are capable of meeting the three most commonly required dc leg conditions, full duplex, half duplex, and carrier terminals tandem connected back to back. The 8 channels normally comprising one group of terminals have mid-frequencies spaced 150 cps apart with the lowest channel centered at 525 and the highest at1575 cps.

This method of operation has two distinct advantages. First, manufacturing and warehousing economies are effected in that the number of different types of oscillators, filters, and discriminators required is only half that needed under the older pattern where all frequencies required to fill the voice-band were directly generated, selected, and detected. Second, the smaller group of channels is found a more convenient unit from the standpoint of traffic routing and dispatching, since a large part of the total network is comprised of feeder circuits to smaller communities which can be served by the small group of channels. This advantage results in the extension of subbands from one system to another by means of subband patches. Patches between complete bands, without separation into subbands, are also employed.

Voice-bands over which the channels are operated are derived from a number of sources as dictated by circumstances. Still, to the telegraph channels all voice-bands appear as two unidirectional paths (four-wire circuits) whether the ultimate transmission medium be a two-wire or a four-wire high-frequency carrier or a radio relay system. Commonly-used transmission mediums are Western Union's own two-wire and four-wire carrier systems, which range in capacity from one subband in either direction using a top frequency of 3-KC to the 150-KC radio relay system which handles 64 subband groups.

The full capacity of the voice band is, of course, not realized when its load is only two groups of eight channels each. On many circuits where the traffic demands, a total of twenty channels are operated in the voice-band by the expedient of assigning the frequency spectrum. Two additional channels are secured by adding the 375-cycle "J" channel to each group. If need be, the 19th and 20th channels, the "K" and "L", are added, completely filling the space left as a guard band between the subband filters. These channel allocations are 1725 and 1875 cps, respectively, maintaining the 150-cycle separation pattern.

Operating performance is measured in terms of circuit margin and continuity of service. Distortion losses due to filters and electronic equipment are extremely small. When a teleprinter circuit is operated through one carrier section the range obtained is practically a short-circuit range. Where two or more carrier sections are operated in tandem, the operating range decreases slightly with each added section. Whenever more than 7 or 8 tandem sections are involved in a given circuit, intermediate regenerative repeaters are provided to reduce the net loss.

There has been a tremendous decrease in lost time with carrier operation in comparison with grounded circuit operation. This is attributable to several major factors, including the prevalent use of cable circuits which are less subject to failure than open wire lines formerly employed. Line-ups necessitated by balance changes due to variable weather conditions are practically eliminated. Earth currents which affect grounded circuits have little or no effect on carrier circuits.

One of the most revolutionary advances in telegraph engineering is the application of shf radio methods to the transmission of Western Union messages. Radio beam telegraphy between New York and Philadelphia, and over a triangular path connecting New York, Washington, and Pittsburgh, is a fact and sites have been

(*Continued on page* 89)

Color-TV Progress

Tube makers given instructions for manufacture of developmental three-gun tri-color kinescope

ALTHOUGH color-television has been generally "put on the shelf" for the duration of the National Emergency, important advances and refinements in color-tube construction and circuitry have already been completed since the last Washington showing, Dec. 6. In fact, as one engineer put it, "the progress to date since Dec. 6, has been substantially as great as was the color-TV progress made between the April and December demonstrations at the capital city."

Color quality is now still better, and detail of picture has advanced to that of the finest color-printing job. Receiver controls are simplified, and set operation has been so stabilized that a 10-minute warm-up period is now ample.

New Phosphors

Abandoning natural phosphors, artificial phosphors are now used exclusively since these can be compounded with far greater color accuracy. The reds are now bright enough to be used without filters, by adjusting electrical levels for the reds, in comparison with those of the green and blue phosphors. There is also promise of new red phosphors which will permit balanced color effects with uniform electrical levels for all three phosphors.

Work on larger color tubes is also going ahead, and the prospect is that for the larger tubes, construction difficulties will be less rather than greater, as the physical scale of the holes and phosphor dots increases.

Early in March, the 30 or more RCA tube licensees were sent instruction bulletins on the manufacture of developmental three-gun tricolor kinescopes. This was a routine mailing supplementing the earlier information bulletins and the inspection visits provided for receiver licensees.

Nickel Aperture Mask

In the process described in the bulletin (which attracted considerable newspaper speculation) a sheet of thin copper-nickel alloy about 1/250 inch in thickness, is first etched with the array of 0.009 inch holes, centered at the apexes of 0.023-inch equilateral triangles. Photo-engraving processes are used to etch the 200,000 small holes in the aperture mask.

By "hot-mounting" the aperture sheet on the heavy spacer frame, with clamps and screws, this copper-nickel sheet cools into a taut condition, like a drum head.

Placed in a "light-house" printing frame over a kodalith photographic plate (spaced at a position corresponding to the future phosphor-screen) light is projected through the apertures-mask from a Western Union concentrated arc light located at a position corresponding to one of the future electron guns (usually the blue). Thus images of the apertures are projected on the Kodalith plate at the positions of the future blue phosphor dots.

Preparing Stencil Pattern

Next this Kodalith plate is used to make a gelatin-stencil printing pattern. Paper-backed pigmented gelatin is sensitized in dichromate solution and while still moist, is given contact exposure with the Kodalith plate. In this way, a mesh-supported gelatin stencil is produced.

This stencil is then aligned on the glass face-plate and a quantity of blue-phosphor paste is squeegeed across the stencil, forcing the phosphor through the stencil apertures onto the glass to form the "blue-dot" pattern. Proper viscosity of phosphor is required to permit flow and to produce round dots of accurate size.

After the blue dots have thus been printed, the stencil must be cleaned and then replaced in its orginal position but accurately shifted by the 0.023 inch between differing color dots. After completing the red-phosphor printing, the cleaning, replacement and shifting process (at a 60-deg. angle) is again repeated for the green phosphor dots. It has further been found desirable to build up the phosphor dots by successive printings two or three times, again in color rotation (that is, nine or more squeegee printings in all).

After being printed, the phosphor-dot plate is baked in the open to burn out the binder, and the plate is then sprayed with a solution of potassium silicate, bonding the phosphors to the glass. After this, the screen is filmed, aluminized and rebaked.

Cover Plate Assembly

The screen assembly with its spacer frame is then mounted on the supporting metal cone attached to the tube body which carries the gun mount. This body cone also encloses a magnetic lining cone which serves as a magnetic shield against local magnetic fields that might produce electron-beam shifts and hence color distortions in parts of the picture. After the operative tube parts have been thus accurately assembled and aligned, the metal-framed glass front cap is then welded on and the tube exhausted.

In the developmental tubes now being constructed, it should be noted that each phosphor-dot screen is made from its own aperture plate as a matrix, although later it is expected that production-line methods will employ standard matrices.

Compatible Color-TV

Advances since Washington showing, Dec. 6, equivalent to April-December progress

Receiver control and stability improved

New red phosphors give promise

Process patterns phosphor-dot screen from own aperture mask

Magnetic shielding of local fields

Supreme Court Studies Color-TV

The United States Supreme Court early in March announced it would grant a hearing in the FCC-CBS-RCA color-television controversy and set March 26th as the date for argument.

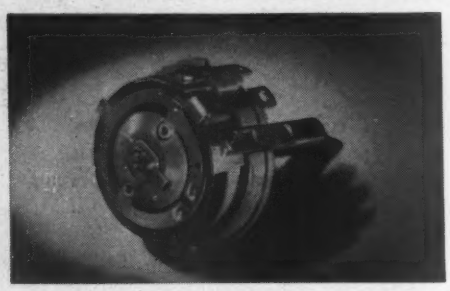
Lawyers have commented that since the Supreme Court could have refused to take the case if it felt that the decision by the lower court was unquestionably correct, the action of the nation's highest tribunal in now taking on the color-TV case, suggests it may want to hand down its own and different final decision in the controversy. Also, the fact that the Supreme Court, pending its decision, specifically continued the injunction against commercial operation of CBS color-TV, is regarded as significant.

New Radio-TV and Communications

Exhibitors report that the items shown here are being displayed for the first time.

Potentiometer

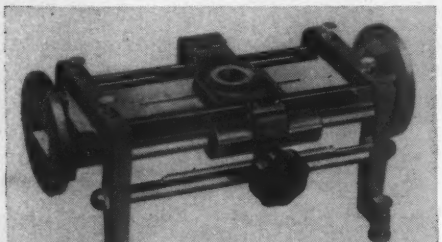
To meet the exceptionally rigid mechanical and electrical specifications, a new potentiometer was designed, tooled



and produced in limited quantities, as a special number. The tapered winding is held to a tolerance of plus/minus 1½% linearity as measured at ten test points. Mechanical tolerances are held as close as plus/minus 0.00025 inch. The unit must operate dependably over extreme ranges of temperature, humidity and altitude or barometric pressure, and under severe vibration. It is treated to meet fungus and corrosive conditions. The body of this special control is moulded in yellow low-loss bakelite. Positive low-loss conductivity is assured by the silver contact carried by the ring-shaped slider which rides the winding as well as the contact rail. A slip-on black plastic cap protects the control mechanism.—**Clarostat Manufacturing Co., Dover, N. H.**—TELE-TECH

Slotted Sections

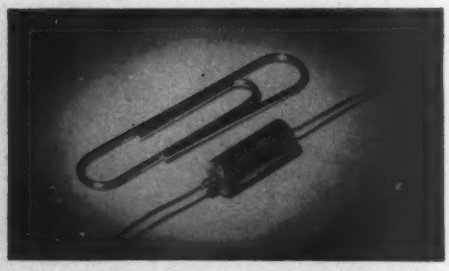
A single precision carriage (-hp- 809B) mounts either slotted waveguide sections or coaxial sections covering the



frequency range from 4.0 to 12.4 Mc. This results in maximum flexibility and minimum cost for complete frequency coverage. The carriage travels on a new 3-point, ball-bearing suspension system; and waveguide or coaxial slotted sections may be quickly interchanged.—**Hewlett-Packard Co., 395 Page Mill Road, Palo Alto, Cal.**—TELE-TECH

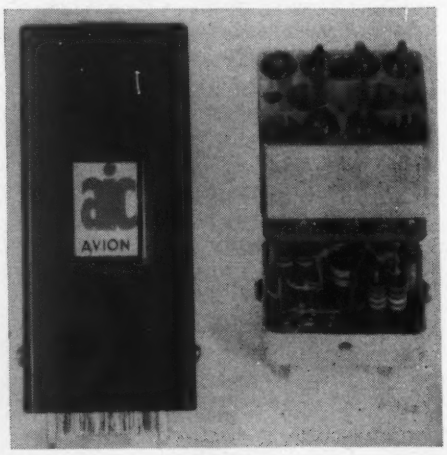
Capacitors

Extra-severe-service requirements in subminiature volume are met by the type P123ZG Aerolite capacitors. The marked size reduction is attained primarily by the metallized-paper section which is Hyvol K or M impregnated and placed in a non-magnetic hermetically-sealed metal case with vitrified ceramic terminal seals. Operating temperatures range from —55° C. to +50° C. without derating, and again at ambient temperatures up to 95° C. with voltage derating. Power factor is less than 1% when measured at or referred to at a frequency of 1 KC and an ambient temperature of 25° C. Other specifications are likewise exceptional in terms of extra-severe-service applications. Type P123ZG Aerolites are available in 200, 400 and 600 v.dc, and capacitance values of .0005 to 2.0 mfd. Dimensions range from .175 in. dia. by 7/16 in. long, up to .670 in. dia. by 2 7/32 in. long. These bare metal-can units may also be had with plastic insulating sleeves, adding .062 in. to the diameter and 1/16 in. to length. —**Aerovox Corp., New Bedford, Mass.**—TELE-TECH



Universal Chassis

To meet a variety of requirements for compact electronic assemblies, a standard chassis has been developed, adapt-



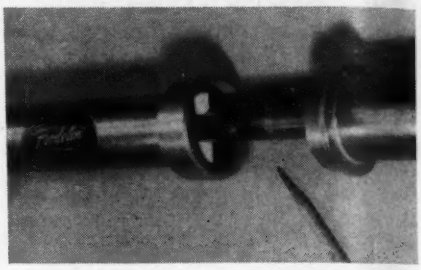
able for use with servo mechanisms, pulse and flip-flop circuits, analog computers and similar devices. Eight to ten sub-miniature tubes can be used. The complete assembly mounts in a metal case filled with a special potting compound. This provides mechanical support for the components, ample heat dissipation and protection from tropical or arctic conditions. Plug-in base permits instant replacement of assembly when necessary. —**Avion Instrument Corp., 121 East 25th St., New York 10, N. Y.**—TELE-TECH

Germanium Photodiode

The type 1N77 is a germanium photodiode, the reverse resistance of which is changed by the incidence of light. It is a point contact device employing a sharply-pointed tungsten whisker firmly seated against a slab of polished germanium. This arrangement, as in most other germanium diodes, permits easy forward flow of electrons from the germanium to the whisker (cathode to anode) and impedes the reverse flow of electrons from the whisker to the germanium (anode to cathode). It is this reverse resistance which in the Type 1N77 has been made especially sensitive to infra-red and visible radiations. The construction of the 1N77 in a small, transparent cylindrical body facilitates the application of light to the sensitive area. The small size of the IN77, only .080 in. diameter, recommends its use wherever space is limited.—**Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.**—TELE-TECH

Transmission Line

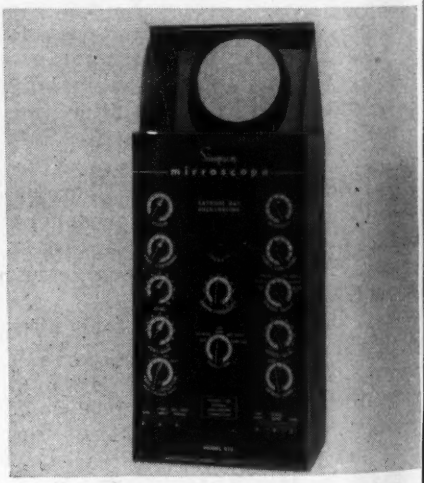
Prodelin one-piece "Air-Tite" couplings are quickly and easily field assembled with only a single set of tools which are



supplied. Insulating structures are unique in performance and designed for optimum operation. "Prodelin" is serving in the largest operating microwave systems with complete satisfaction, both in military and commercial services, up to 3,500 MC with VSWR values of 1.1 or better. These transmission lines are designed to meet various communication requirements, under normal or extremes of temperature.—**Product Development Co., Inc., Arlington, N. J.**—TELE-TECH

Mirroscope

The objectives behind the design of the Model 476 were to eliminate certain inherent disadvantages found in the con-



ventional type of oscillograph. By use of the Mirroscope princple the 5 in. cathode ray tube is mounted in a vertical position. This construction reduces bench space requirements to an area of only 9 x 8 in. thereby permitting better concentration of associated equipment for any type of test procedure. The cathode ray image is reflected from a high grade mirror mounted in the adjustable cover at the top of the cabinet, thus the viewing surface is brought near eye level when the instrument is used on benches of normal height. The mirror angle is quickly and easily adjusted to any position of the operator. The cover with integral side wings form an effective shield against external light sources or may be closed down for protection of the tube and mirror when the instrument is not in use. The upright construction permits location of controls and connections for maximum convenience and allows for internal cathode ray tube connections at the front of the panel instead of the rear. —**Simpson Electric Co., 5200 West Kinzie St., Chicago, Ill.**—TELE-TECH

Products at IRE Show

Largest volume of new equipment in test instrument and component manufacturing fields.

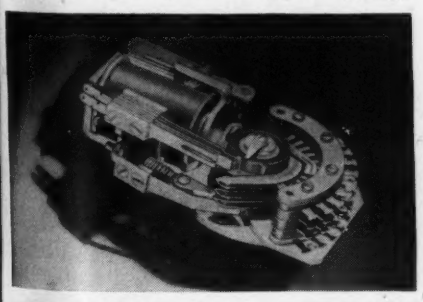
Intermodulation Meter

Modedl 31 intermodulation meter consists of two principal sections: a test signal generator and an analyzer, with

a built-in supply providing power for both units. The generator section produces the mixed low-frequency and high-frequency signal required for intermodulation testing. Voltage from the power transformer provides the low-frequency; the high-frequency is supplied by an L-C oscillator. These two frequencies are then mixed and applied across an output potentiometer, the voltage being adequate to directly test most amplifiers. The analyzer section receives the mixed signal from the apparatus under test, removes the low-frequency test signal, then amplifies and rectifies the remaining high-frequency carrier. The output of the rectifier is passed through a low-pass filter to remove the high-frequency carrier, leaving only the frequency component resulting from intermodulation in the equipment under test. A direct-reading meter contained in the analyzer section indicates the percentage of intermodulation and measures the input voltage to the analyzer. — **Measurements Corp., Boonton, N. J.**—TELE-TECH

Rotary Stepping Switch

The type 44 rotary stepping switch is so small that equipped with three 10-point bank levels, 2 interrupter springs



and the maximum number of off-normal springs, it mounts in the space of one Automatic Electric "right relay." Each bank level has a corresponding wiper level, and the entire wiper assembly is driven by a ratchet wheel with 33 teeth. This provides 10 on-the-bank positions followed by 1 off-the-bank position for each one-third revolution of the wiper assembly. By proper wiper arrangement, contact bank levels can be used singly for 1-point operation; in pairs for 20-point operation; or in groups of three for 30-point operation.—**Automatic Electric Co., 1033 Van Buren St., Chicago 7, Ill.**—TELE-TECH

Transmitting Tubes

Type AX-9906R/6078 is said to be the world's highest power air-cooled tube with a plate dissipation of 45 kw and a weight of only 66 lbs. The remarkably high ratio of plate dissipation to weight is obtained by virtue of the fact that the tube employs new, high efficiency radiator fins and a unique air flow changer. High velocity air is diverted in the assembly into a number of parallel paths, thus minimizing the total pressure. Designed for high power transmitter and industrial applications, the triode produces an output of 108 kw at 15 MC and is intended for operation up to a maximum frequency of 30 MC. The maximum plate voltage is 13,500 v. and maximum plate current is 12 amps. Type AX-9906/6077 is the water-cooled version of the above and has an available plate dissipation of 100 kw.

Type AX-9907/6077 is a high frequency, water-cooled tetrode especially suitable for the final stage TV transmitters. The tube may be employed up to a maximum frequency of 220 MC, and has a maximum plate dissipation of 3 kw, maximum plate voltage of 5 KV and a maximum plate current of 1.1 amps. The screen grid terminates in a kovar disc seal which shortens the path from the external connection to the active part of the grid. Type AX9907R/6076 is the air-cooled version of the above.

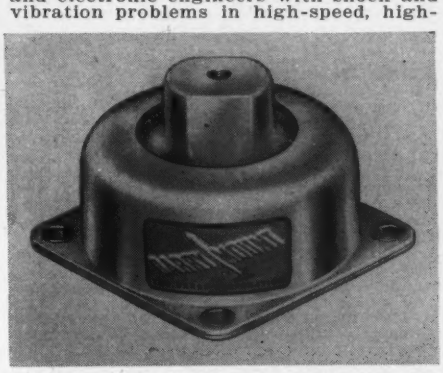
The AX-9908/6079 is a radiation cooled tetrode for communications applications. A powdered glass base is used which makes for excellent cooling since it eliminates the necessity of an additional external base. This tube operates at a maximum frequency of 75 MC and has a maximum plate dissipation of 500 watts. For class C telegraphy it is rated at 1750 watts plate output with 10 watts driving power at 75 MC. The maximum plate voltage is 5000 volts and maximum plate current is 600 ma.—**Amperex Electronic Corp., 25 Washington St., Brooklyn, N. Y.**—TELE-TECH

Winding Machines

The Boesch high speed toroidal winding machines are offered in both a completely automatic and a hand operated assembly. These machines wind from #42 through #20 gauge wire on a wide variety of core sizes. The automatic winder has a nominal winding speed of 1150 rpm. These machines and their various features are patented or in the process of patenting by Western Electric co., Inc. — **Boesch Manufacturing Co., Inc., Danbury, Conn.**—TELE-TECH.

Vibration Isolators

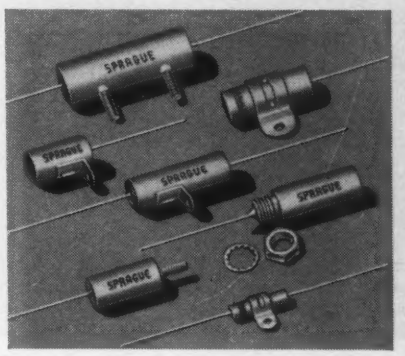
Designed specifically to assist aircraft and electronic engineers with shock and vibration problems in high-speed, high-



altitude flight, these shock and vibration isolators were developed from a research program begun in 1946. Operation under unusual flight conditions is made possible by a completely metallic construction; metal springs handle large static deflections without perceptible drift, and highly compressible, resilient, knitted wire pads provide vibration damping. The mounts contain no organic materials subject to adverse temperature influence. These All Metel Barrymounts are unit mountings, interchangeable with air-damped and other isolators now in use. The unit mount is 2⅜ in. square and 1-19/64 in. high, under minimum rated load. The four mounting holes are on 1-15/16 in. centers.—**Barry Corp., 7008 Pleasant St., Watertown, Mass.**—TELE-TECH

Capacitors

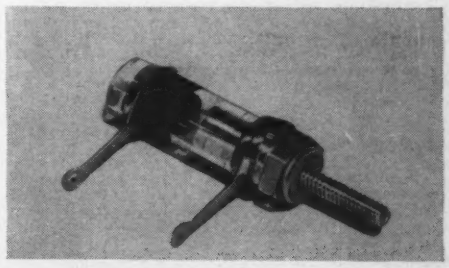
New ways of mounting subminiature metal-encased paper capacitors as well as a complete line of subminiature 125°C. capacitors have been developed. Avail-



able as standard for the first time are hermetically-sealed tiny threaded-neck, side-stud and end-stud capacitors as well as vertical and horizontal bracket mounting units. These new mounting arrangements are intended to help equipment designers overcome vibration and shock problems encountered when mounting capacitors by wire leads in military gear. The 125° C. continuous operating temperature capacitors use Vitamin Q, Sprague's exclusive organic polymer capacitor impregnant. These subminiature units are available in voltage ratings from 100 to 1,000 volts dc in both inserted tab and extended foil constructions. — **Sprague Electric Co., North Adams, Mass.**—TELE-TECH

Capacitor

The new JFD trimmer capacitor provides the minimum capacities needed for exceptionally accurate and stable elec-



tronic adjustments. Tubular in design, it delivers continually uniform change of capacitance in relation to rotation. Smooth, precise setting can be made and maintained without backlash or disturbance from severe vibrations. Thread wear is automatically taken up. Extremely compact, it is only 1-in. long.—**JFD Manufacturing Co., 6101 16th Ave., Brooklyn 4, N. Y.**—TELE-TECH

Rare Gases

Linde M.S.C. is the new designation for five rare gases: helium, neon, argon, krypton, and xenon, which go into various electronic devices and radiation detectors. M.S.C. means that the gases are mass spectrometer checked for purity. This, the most accurate check possible, assures gases of uniform high purity, and with rare gases, purity and quality are synonymous. When specified, Linde will provide a statement of purity showing the concentrations of all gases present.—**Linde Air Products Co., 30 East 42nd St., New York, N. Y.**—TELE-TECH

IRE NEW PRODUCTS (Continued)

Oscillograph

The new type 293 oscillograph offers a wholly new approach to the problem of high-voltage impulse test recording.

It is supplied as a complete recording and indicating instrument, consisting of the cathode-ray tube with its high-voltage power supplies, input attenuators, sweep circuits, a trigger generator for initiating external circuits, provision of calibration of both time and amplitude, and the power supply which provides for the operation of these circuits. Also included is a specially designed camera, by means of which test waves may be conveniently recorded. To facilitate the recording of the extremely high writing rates found in impulse-testwaves, a special high-voltage cathode-ray tube (Type K1068P11) has been developed for use in the 293. Vertical deflection-signal attenuation: 10 steps of attenuation permit control of signal amplitude in increments of 10% of unattenuated value. Frequency response is independent of attenuator setting. Accuracy for any step, 1% maximum. Horizontal deflection-signal attenuation: 10 steps of attenuation permit control of signal amplitude in increments of 10% of unattenuated value. Frequency response independent of attenuator setting. Accuracy for any step, 1% maximum. Frequency Response: essentially uniform from dc to 25 MC per second.—**Allen B. Du Mont Laboratories, Inc., Clifton, N. J.**—TELE-TECH

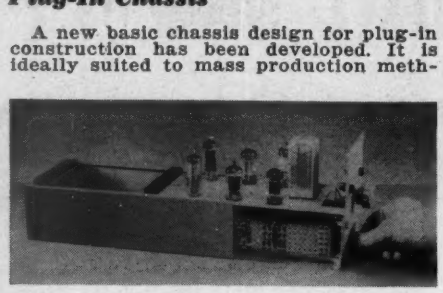
Telephone Type Jack

A new long frame type Jack, most commonly referred to as a telephone jack, has been designed especially for

high quality communication equipment, and to meet the exacting specifications of the armed services. Known as "T-Jax" it has a rugged steel frame, produced in specially designed dies. The springs are produced in dies of Switchcraft design and are made of a special alloy of nickel silver insuring maximum spring life and corrosion resistance. Fine silver contacts are standard in switching circuits; palladium cross bar contacts are also available. Insulation is in accordance with military standards.—**Switchcraft Inc., 1328 N. Halsted St., Chicago 22, Ill.**—TELE-TECH

Plug-In Chassis

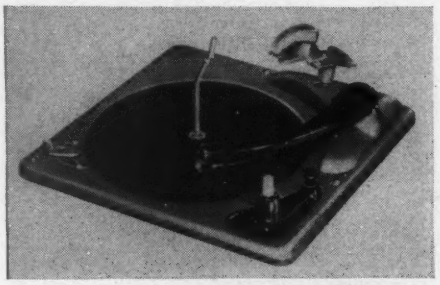
A new basic chassis design for plug-in construction has been developed. It is ideally suited to mass production meth-



ods. In fabrication, the work proceeds as a flat piece as it is sheared and blanked, and, since the operations are principally benching, the work moves to plating or painting and assembly with little or no lost effort. Circuits and components can be wired and assembled as sub-assemblies. The completed assembly is a neat and efficient plug-in, slide-in unit. Mounted in a cabinet or panel rack in horizontal or vertical succession, chassis elements are always instantly accessible for check, service, or replacement.—**Alden Products Co., 177 N. Main St., Brockton, Mass.**—TELE-TECH

3-Speed Phono

A new three-speed phonograph replacement unit has been developed which plays all three speeds of records and all



three sizes automatically. It has a record push-off shelf position for each of the three record diameters and an automatic needle set-down point controlled by the position of the push-off shelf. On this unit, Model 106-1, a muting switch silences the radio or amplifier during the record change.—**Webster Chicago Corp., 5626 Bloomingdale Ave., Chicago, Ill.**—TELE-TECH

Time Interval Meter

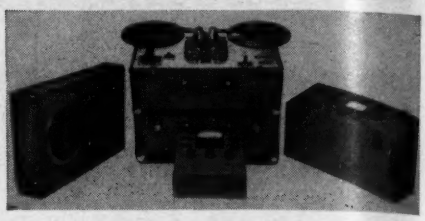
The Berkeley Time Interval Meter Model 500 provides a direct indication of elapsed time between any two events in the range of 0.0001 to 1.0000 seconds. The accuracy of measurement is ±0.0001. Any occurrences that can be translated into changing electrical voltages may be timed. The timing may be started and stopped by independent voltages. By the use of photocell attachments, the duration of a light flash or the interval between two light flashes may be timed. The polarity and amplitude of the control voltages may be selected, by means of toggle switches, so that the unit may be started and stopped by either a positive or negative voltage. The amplitude of the start or stop voltage may be selected so that the unit will operate to any desired position on a voltage wave, ignoring all changes of lower amplitude. —**Berkeley Scientific Corp., 2200 Wright Ave., Richmond, Calif.**—TELE-TECH

REPORTS

on Additional Equipment and Components Being Exhibited Appear on Pages 56 and 66

Tape Recorder

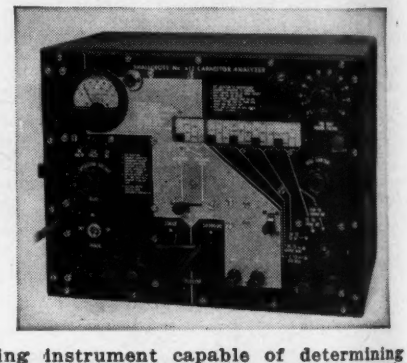
The R5PM Magnetic Tape Recorder has an exceptionally low flutter characteristic being in the order of .05%



peak. This extremely accurate tape motion has been achieved by the utilization of a tight loop or drive, common in the motion picture recording industry, but exclusive with Rangertone with regard to sprocketless quarter inch magnetic tape. A double rubber roller drive capstan grips the tape on both sides of the loop so as to effectively isolate any variations introduced by the take-up and rewind motors and thus eliminating the primary source of low frequency flutter. A four-pound, four-in. diameter flywheel has been inserted within the loop between the record and playback heads where it is always most effective. Flutter introduced by the synchronous tape drive motor or by friction of the tape as it moves across the heads is eliminated by this high Q flywheel system.—**Rangertone Inc., 73 Winthrop St., Newark 4, N. J.**—TELE-TECH

Capacitor Analyzer

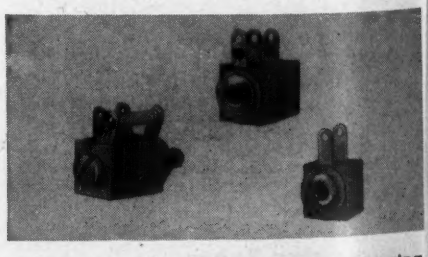
A new laboratory-type capacitor analyzer meets the need for a highly accurate, wide-range, direct-reading measur-



ing instrument capable of determining the essential characteristics of capacitors. This instrument will determine capacitance values between 5 mmfd and 12,000 mfd; insulation resistance from 1.1 to 12,000 megohms; also leakage current, dielectric strength, and percentage power factor. A divided panel carrying an outline of the operating instructions makes it readily possible to use the instrument without reference to an instruction book. It operates on 110 volts, 60-cycle alternating current.—**Shalleross Manufacturing Co., Collingdale, Pa.**—TELE-TECH

Selenium Rectifier

Two miniature selenum rectifiers have been developed which are ideally suited in size and rating. They are: no. 8J1



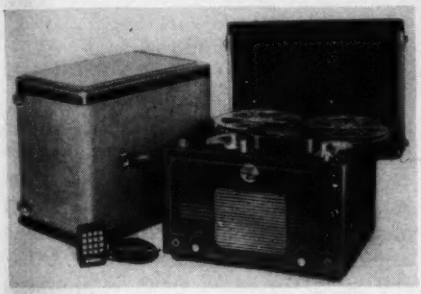
rated at 65 Ma. and no. 8Y1 measuring only ½ in. square and rated at 20 Ma., 130 volts. While these rectifiers are designed to meet television needs, engineers will find many applications for them in other electronic circuits. Other bias type rectifiers rated up to 260 volts are also available.—**Radio Receptor Co., Inc., 251 W. 19th St., New York 11, N. Y.**—TELE-TECH

Glow Modulator Tubes

The Glow Modulator Tubes, tubes 1B59/R1130B and R1131C are cold cathode light modulating tubes, whose particular value lies in an essentially linear relationship between light output and current. A hollow or crater-type cathode provides high ionization density and a narrow light beam which is particularly useful in many applications. In picture transmission applications, the tube serves as a modulated light source in the receiver unit. The picture to be transmitted is scanned by a beam of light. The light reflections from the surface of the picture are picked up by a photo tube which converts them to current variations. This varying current is fed in the receiver to the glow modulator tube which, in turn, reconverts it to light. By synchronized scanning, the glow modulator tube light beam reproduces the original picture on a photosensitive paper or film. By virtue of its highly actinic light, high frequency capabilities, and directional characteristics, the glow modulator tube has found numerous other applications. It can be used as a light source for oscillograph timing markers, stroboscopes, seismograph recorders and photo-electric counters.—**Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.**—TELE-TECH

Tape Recorders

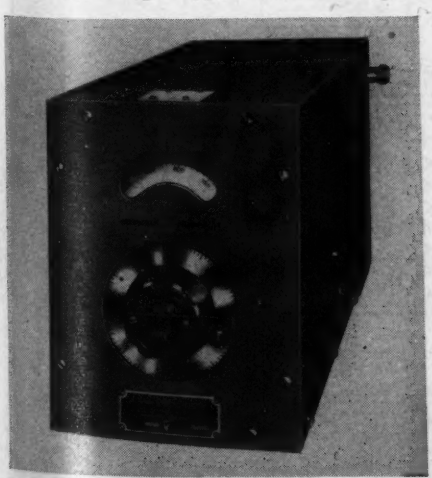
A new line of magnetic tape recorders feature dual-speed, dual-track operation at 3.75 and 7.50 in./sec. Frequency re-



sponses are: 80-8500± 3 DB fast forward speed; 80-5000 cps ±3 DB at slow speed. Recording times are: two hours dual-track; one hour single track at 3.75 in./sec., one hour dual-track, one-half hour single track at 7.50 in./sec. Speed change is accomplished by push-botton operation which permits instantaneous speed change at any position on the tape. Separate amplifier equalization is provided for each speed. Units are available with or without built-in superheterodyne AM tuner.—**Mark Simpson Manufacturing Co., Inc., 32-28 Forty-ninth St., Long Island City, N. Y.**—TELE-TECH

Power and Test Equipment

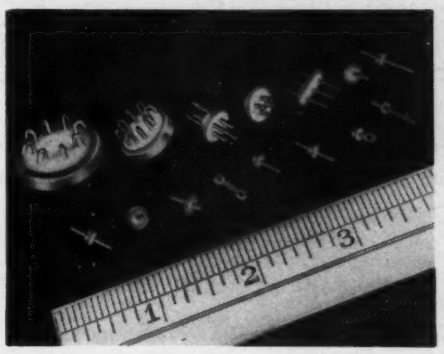
Type 801-A universal klystron power supply has been redesigned to energize a large variety of klystrons. Beam voltages from 300 to 3600 volts are now available, together with the reflector, grid, and modulation supplies which were previously offered. Type 627 broadband coaxial bolometer mount is available for the accurate measurement of absolute r-f power levels between 20 and 10,000 MC when used with the type 650 universal power bridge. Type 142 series of fixed



coaxial pads covers the frequency range of 0 to 1000 MC and are available in several different values of attenuation from 3 to 20 db. They are bilaterally matched and offer nearly constant attenuation over the specified frequency range. Type 578-A precision frequency meter (illustrated) is one of a series of similar units covering the frequency range from 550 to 3950 MC. Both reaction and transmission types are offered. Type 143 high power coaxial pad is rated at a maximum input of five watts of average power. In conjunction with other similar units, the entire spectrum from dc to 10,000 MC is covered.—**Polytechnic Research & Development Co. Inc., 202 Tillary St., rooklyn 1, N. Y.**—TELE-TECH.

Hermetic Seal Miniatures

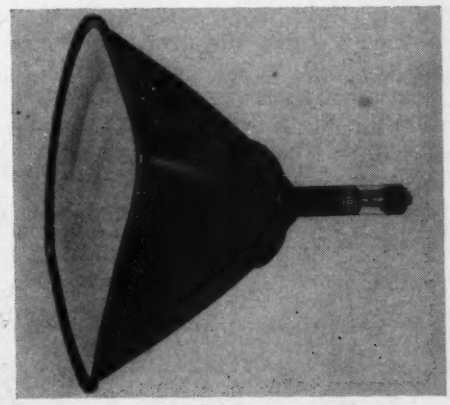
These miniature innovations in hermetic seals have been widely accepted by the armed services for vital components. They are the only seals that can



be hot-tin dipped at 525° F. for easy assembly soldering, for a strain and fissure-free sealed part with resistance of over 10,000 megohms. They will withstand sub-zero conditions, swamp test, temperature cycling, high vacuum, high pressure and salt water immersion and spray.—**Hermetic Seal Products Co., 29-31 S. 6th St., Newark 7, N. Y.**—TELE-TECH

Rectangular Kinescope

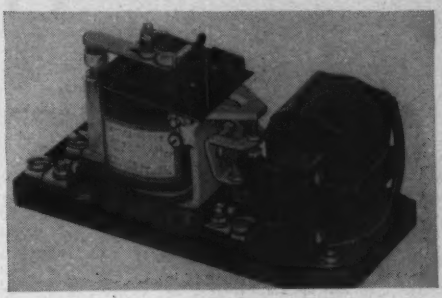
Type 17GP4 is a new, 17-in. rectangular picture tube which requires no focusing magnet with resultant important



savings in critical materials. Featuring electrostatic focusing, it uses an electron gun of improved design to provide good uniformity of focus over the entire picture area. Furthermore, focus is maintained automatically with variation in line voltage and with adjustment of picture brightness. Need for alignment of a focusing magnet is eliminated and therefore tube installation and adjustment for optimum performance are simplified. Because the electron gun is designed so that the focusing electrode takes negligible current, the voltage for the focusing electrode can be provided easily and economically. Employing magnetic deflection, the 17GP4 has a diagonal deflection angle of 70° and a horizontal deflection angle of 66°.—**Radio Corporation of America, RCA Victor Division, Tube Dept., Harrison, N. J.**—TELE-TECH

Relays

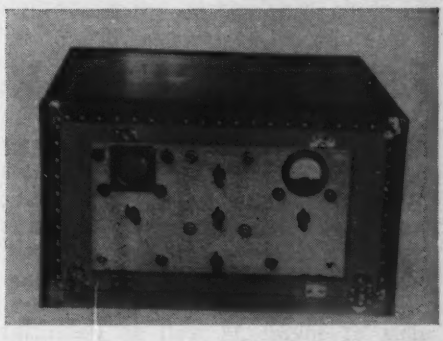
Bulletin 401 AC voltage sensitive relays are intended for use in circuits where a close voltage differential be-



tween relay-pick-up and drop-out is needed. A typical application is protecting motors up to 2 hp against damage caused by low line voltages. Bulletin 401 relays consist essentially of an insulating base on which are mounted a power type Bulletin 103 or 130 ac magnetic relay, with S.P. N.O. contacts and a small saturable reactor. The relay coil and reactor are connected in series. Because the reactor imparts non-linear characteristics to the relay circuit, slight voltage changes across the series combination result in wide current variations required for close differential operation. Unlike ordinary voltage sensitive relays, Bulletin 401 relays are chatter-free and are capable of switching relatively large amounts of power.—**Ward Leonard Electric Co., Mount Vernon, N. Y.**—TELE-TECH

Servoscope

The Servoscope is a precision analyzer for measuring the response of servomechanism systems and components to



sinusoidally modulated carrier or low frequency ac signals over a continuously variable frequency range of .1 to 20 cps. This instrument, in conjunction with a cathode ray oscilloscope, may be used to measure the relative amplitude and phase angle of any ac or dc servo system, servo component, automatic control or regulator. Primarily developed for the design of feedback control systems, the instrument may also be used as a stable generator of low frequency sine and square waves. ac carrier frequencies of 50 to 800 cps are accepted to produce sinusoidally modulated suppressed carrier signals.—**Servo Corporation of America, 20-20 Jericho Turnpike, New Hyde Park, N. Y.**—TELE-TECH

Terminal Blocks

The standard Kulka line of barrier type terminal blocks is made in four sizes and in several styles of molded Bakelite having a high tensile strength, and with the barriers designed fairly high and running around edge of block to the base. This assures elimination of short circuits and leakage between terminals. All terminal blocks can be furnished in the following materials made in accordance with Army-Navy specifications JAN-P-14—MTS-E-1, MTS-E-3, MTS E-4, MTS-G-2, MTS-G-3. Terminals and binder screws are of brass, heavily nickel-plated and binder heads are large to facilitate connecting. Lugs are of of brass, and hot-tinned for quick soldering. Mounting holes are provided at each end of block. Fiber marker strips are available for use in designating terminals and a special service is provided to imprint requirements in several sizes and styles.—**Kulka Electric Mfg. Co., Inc., Mount Vernon, N. Y.**—TELE-TECH

TV Receiver Operation with

A review of r-f, i-f deflection circuit design problems encountered when transformerless

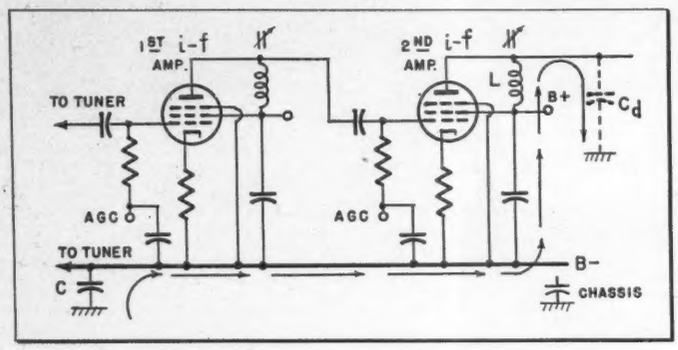


Fig. 1: Undesirable feedback with capacity bypass of B— to chassis

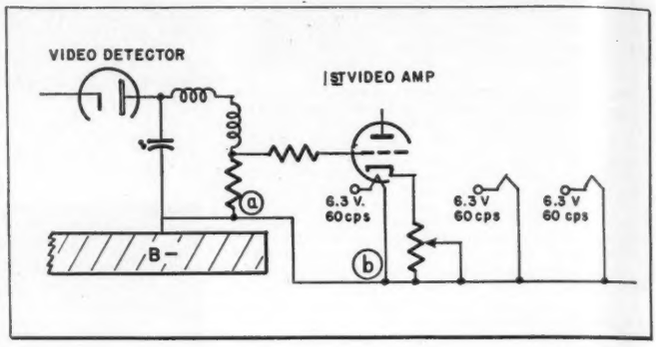


Fig. 2: Undesirable hum coupling through common B— return

By ***EDWARD S. WHITE,*** *Assistant Chief of Advanced Development*
Air King Products Co., 160—53 St., Brooklyn, N. Y.

UNTIL recently, the overwhelming majority of television receivers produced have employed transformer power supplies with the chassis proper serving as a natural grounding plane for all circuits. With this obvious reference plane determined, design considerations have become fairly well defined. However, shortages of metal as well as potential cost reductions have impelled manufacturers to consider television receiver operation without power transformers.

Selenium rectifiers, employed in conventional doubler or tripler circuits, are capable of supplying the necessary dc voltages. Doubler circuits, delivering a well filtered plus 250 volts, are adequate for proper operation of 70° deflection angle kinescopes with conventional deflection circuits. Design problems arise, however, when the use of a "floating" B minus bus is considered.

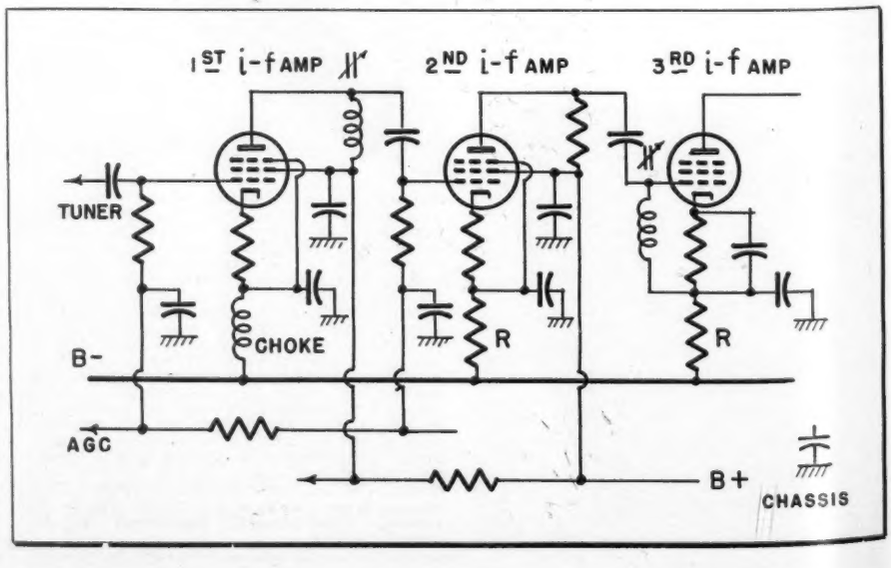
A great deal of highly definitive work has been done on the subject of feedback analysis.[1,2] The attempt has been made in this paper to apply these established fundamentals towards a precise statement and solution of these problems.

Whereas the chassis proper, having considerable metallic dimensions, approximates a true zero impedance plane with its attendant shielding properties, a B minus bus presents neither of these advantages. The use of capacitance bypassing of B minus to chassis proper to hold the B minus bus to chassis potential is almost imperative to prevent the bus from acting as a source of i-f frequency radiation. The inherent disadvantage of this approach is illustrated in Fig. 1.

Fig. 1 shows the first two stages of the picture i-f channel with a floating B minus bypassed to chassis through C. Since the maximum i-f currrents which flow are those which circulate around the resonant tank circuits, the circulating current flowing through L and C_d tends to set up a potential difference along the B minus line, parts of which are impressed across the grid-cathode electrodes of both tubes resulting in undesirable feedback effects. Only one such feedback path is shown in this simplified figure; in actual practice, the number and location of the feedback paths may be much more complex. Since the i-f chassis currents of all the i-f amplifier tubes flow back to the B minus bus through the indivdual capacitor point bypasses, heavy concentrations of current may be built up in the immediate vicinity of these bypasses.

The various design problems inherent in the use of a "floating" B minus bus would be minimized by

Fig. 3: An approach to maintain the B— bus free of i-f currents



"Floating" B Minus Bus

power supplies are used to conserve raw materials and to reduce manufacturing costs

connecting one end of the power line directly to chassis thereby placing the entire chassis at B minus potential. However, in order to obtain Underwriters' Laboratory approval, a considerable amount of insulating and isolating would be necessary, resulting in increased production costs.

Broadcast receiver manufacturers are familiar with the hum and i-f amplifier regenerative difficulties encountered with a "floating" B minus bus. In television receivers, due to the increased complexity and higher i-f frequencies employed, the difficulties may be many more times severe. Essentially, the problems are:

1—The i-f amplifier channels must be kept "cold"; that is, free of undesirable feedback paths. Since the most commonly used picture i-f frequencies are in the 21 to 25 MC region, and the newly proposed i-f frequencies are in the 41 to 45 MC region, small inductive and resistive properties of the B minus bus cannot be neglected. In the split sound type of receiver, similiar consideration must be given to the sound i-f amplifier channel.

2—In intercarrier sound television receivers, harmonics of the 4.5 MC beat frequency must be kept out of the r-f and i-f circuits. These harmonics are generated principally by the non-linear action of the ratio detector or discriminator circuits plus their associated driver stages. When coupled into the r-f circuits, the interference effect is most pronounced when receiving a weak, lower channel signal with an unbalanced antenna.

3—Unavoidable stray capacities from the horizontal output transformer to chassis cause 15,750 KC repetition rate pulse currents to flow through the chassis. Pick-up in the video amplifier, and sometimes in the picture i-f amplifier, may result in distorted sync pulses in the composite video signal applied to the sync separator. This places an additional burden upon the synchronizing function, particularly for weak signals.

4—Vertical frequency pulse energy may be coupled from the chassis directly into the audio circuits, resulting in acoustical buzz.

5—Harmonics of the picture i-f carrier frequency may be coupled more easily into the r-f circuit resulting in visible interference patterns.

6—Hum 60 cps may be coupled directly into the various r-f, i-f, video, sound, sync, a-f-c, and deflecting circuits unless particular attention is paid to common B minus connections.

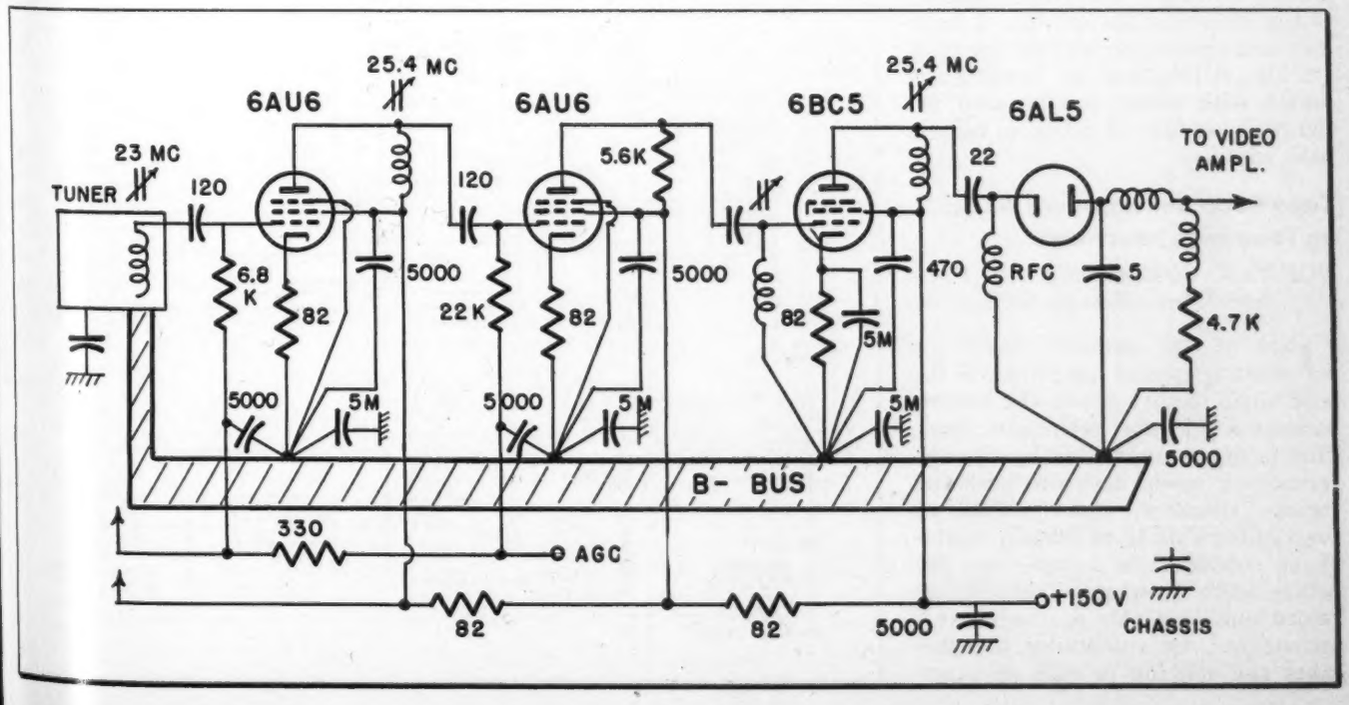
The problem of maintaining a "cold" i-f is the most complicated of the problems enumerated. While no general rule is available, the other defects may be eliminated by proper lay-out, lead dress, bypassing at critical points, and awareness of possible feedback paths through common B minus leads. These precautions are, of course, applicable also to the i-f problem, but additional major considerations are necessary.

Approaches to Problem

There are several approaches to this i-f problem. In one approach a tuner and i-f sub-assembly are both maintained at B minus potential and insulated from the main chassis. The thinking behind this is that since the sub-assembly itself has large metallic dimensions, a close approach to a zero impedance B minus plane will be achieved, making point capacitor bypassing to main chassis, with its attendant disadvantages, unnecessary. Some bypassing, however, may still be required, particularly in the attempt to keep harmonics of the 4.5 MC beat out of the r-f and i-f amplifier channels. This interference may occur if a potential difference exists between main chassis and sub-assembly, permitting this

(*Continued on page* 80)

Fig. 4: Schematic of i-f amplifier section with large dimension B— Bus



CUES for BROADCASTERS

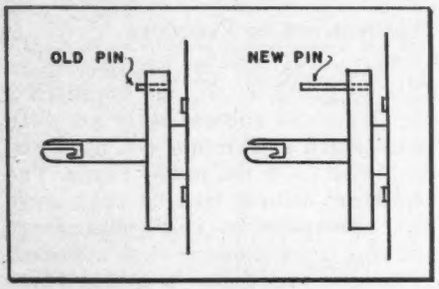
Practical ways of improving station operation and efficiency

Edited by John H. Battison

Magnecorder Modifications

E. W. WILLIAMS, Jr., Chief Engineer, WTWA, Thomson, Ga.

ON our Magnecorder mechanical unit it has been noticed that the empty or partially full take-up reel would continue spinning after switching off the fast rewind. The clutch and spindle then stop and the tape becomes fouled up. In addition,



Lengthened take-up pin improves rewind.

the take-up reel would invariably be chewed up by the small driving pin on the spindle assembly.

Adjusting the clutch either left the tape too loose on the rewind, or did not permit correct take-up during recording or playback.

The trouble was remedied by removing the short drive pins and replacing them with pins at least long enough to come all the way through the reel. The short pin has to be pushed out from the front, necessitating removing the spindle. A hammer and nail punch will do the trick quickly. A length of 1/8" brazing rod coated with solder can be used for the replacement. It is best to replace both spindles.

Tape Recorder Improves Audio on Telephone Interviews

NORMAN CUMMINGS, 116 Pinehurst Ave., New York 33, N. Y.

ONE of the greatest faults on most telephone interviews is the poor audio quality due to the narrow band-pass of the telephone lines. This is often augmented by the difference in levels between local and remote speakers. One method of overcoming this is to place a microphone connected to a tape recorder before each speaker. These mikes record only one side of the conversation; but by combining the two tapes and splicing in each speakers' remarks, in turn, the effect of a two-way talk is obtained. Also, studio quality is obtained as well as the authentic *psychological* feeling of a 'phone call.

$$$ FOR YOUR IDEAS

Readers are invited to contribute their own suggestions which should be short and include photographs or rough sketches. Typewritten, double-spaced text is preferred. Our usual rates will be paid for material used.

Emergency Remote Power Supply

RUSSEL GRAMBSCH, WDLB and WDLB-FM, Marshfield, Wis.

OCCASIONALLY on broadcasts of sporting events power is interrupted, or located a block or more away, so it is desirable to have a reserve power supply which can be turned on with a minimum time loss. B batteries are unsatisfactory because of the limited shelf life.

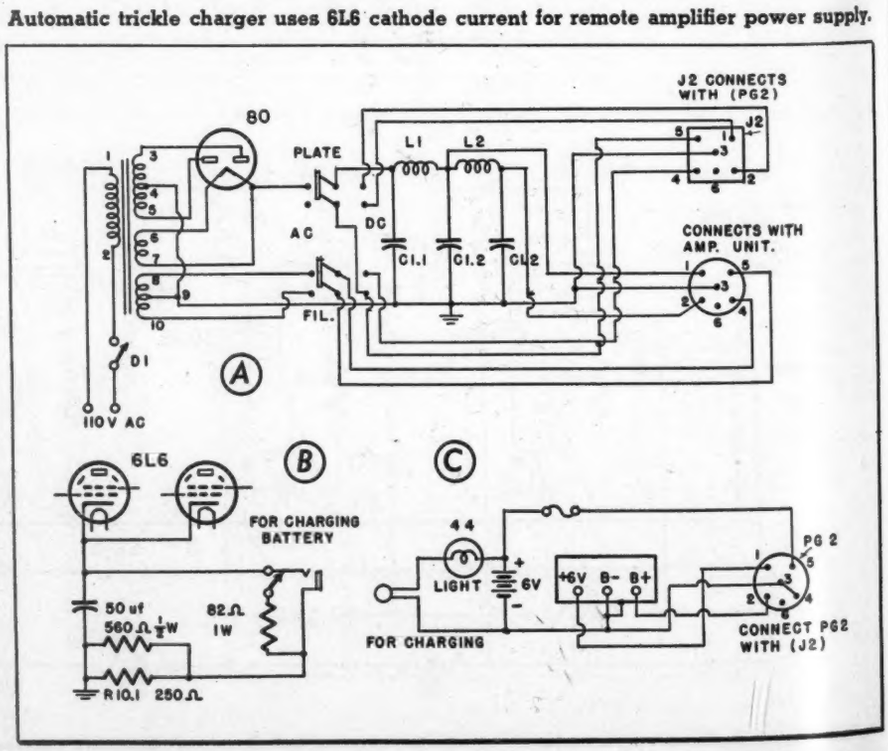
The diagram shows our Western Electric type 22D amplifier's power supply after a few simple changes were made which enable it to be powered from a 6 v. storage battery as well as 110 v. ac. This amplifier was originally designed to be powered by a 6 v. storage battery and four B batteries, or 110 v. ac. Similar changes could also be made in other remote amplifiers.

In our case a B supply of 20 mills at 135 v. is satisfactory. The only filtering used inside the vibrator supply box is the r-f choke and small by-pass condenser. The markings on the filament and plate switches are left as are. These are, dc in one direction and ac in the other. the plate switch on dc turns on the vibrator supply, this can be used with either ac or dc on the filaments. These switches could be replaced with a relay which would be excited across a winding on the power transformer thereby giving automatic operation. We didn't feel this was necessary in our case, so far we have been able to switch it fast enough during the few power failures we have had.

The battery is a small 20 amp-hour 6 v. unit. The vibrator unit has a synchronous vibrator and is from a Zenith farm radio. Any similar vibrator supply can be easily picked up or built.

As the unit is seldom used I decided to design a circuit to charge the battery without the expense of a

Automatic trickle charger uses 6L6 cathode current for remote amplifier power supply.



charger. It is charged in the 6L6 cathode circuit of the monitoring amplifier, a Western Electric 124D. The battery charges at .08 amps while on the air, and the dc leakage of the 50 μf condenser when off the air is very small. The light in series with the battery when charging is to prevent the phone plug from shorting the battery when it is being plugged in.

Preventing Switching Transients

R. S. HOUSTON, 18 Oak Lane, Haverstown, Pa.

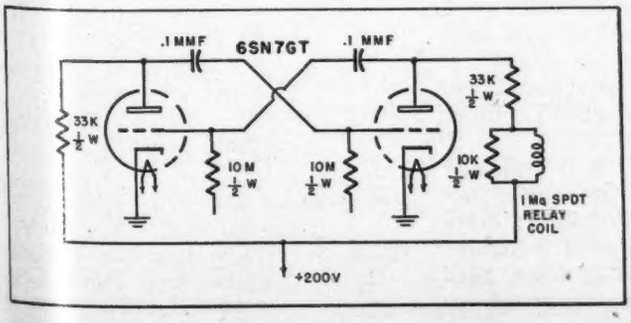
RESISTORS can be used to prevent switching transients on rotary test monitor switches. The usual procedure on a test monitor is to have the wiper of the switch run into two 10,000 ohms resistors, and then to a 500 ohm input amplifier. Due to static effects, noise sometimes gets back into the lines during switching. By inserting the 10,000 ohms resistors in series with each of the stationary contacts and their respective lines, any noise developed will be attenuated about 13 DB before getting back to the line. The wiper arm goes directly to the 500 ohm input in this case. Some of the static that develops on these inputs can be neutralized by the simple expedient of grounding a center tap on the input, and all the other circuits involved. They thus are brought to the same potential and the "pop" when the two circuits are connected is eliminated.

AM-FM Audio Monitor

GENE RIDER, Chief Engineer WQAM; and WQAM-FM, Miami, Fla.

AT many stations the plant engineer on duty is required to run both AM and FM transmitters. In the majority of cases both transmitters carry the same program. At WQAM it was customary to monitor the AM transmission most of the time, keying the monitor over to FM for an occasional sample, and relying on the FM modulation monitor as a visual indication the greater part of the time. Recently an electronic switching device was built which switches one monitoring amplifier from AM to FM modulation monitor audio outputs every three seconds without a trace of a program break. No compression is used on the FM transmission but by careful adjustment of input levels going into the switch, there is only a slight difference in the speaker level as the flip-flop circuit goes back and forth between compressed AM program and non-limited FM program. Since the FM transmitter is on the air only one half as much as the AM, it is merely necessary to turn off the switch's power supply when monitoring AM only. In the de-energized position, the relay falls to AM. By varying resistor values, different switch timing may be obtained. The values shown are for 3-second switching.

(below) AM-FM monitor flip-flop changeover circuit.



Scotch Tape to the Rescue!

E. D. CASEY, Chief Engineer, KGAR, Garden City, Kansas

SLUGGISH muting relays (due to magnetization of the core), can be corrected by inserting a piece of scotch tape between the core and movable leaf of the relay.

Remote Cueing System

By KENNETH E. RUPPE, Chief Engineer, WBBZ, Ponca City, Oklahoma

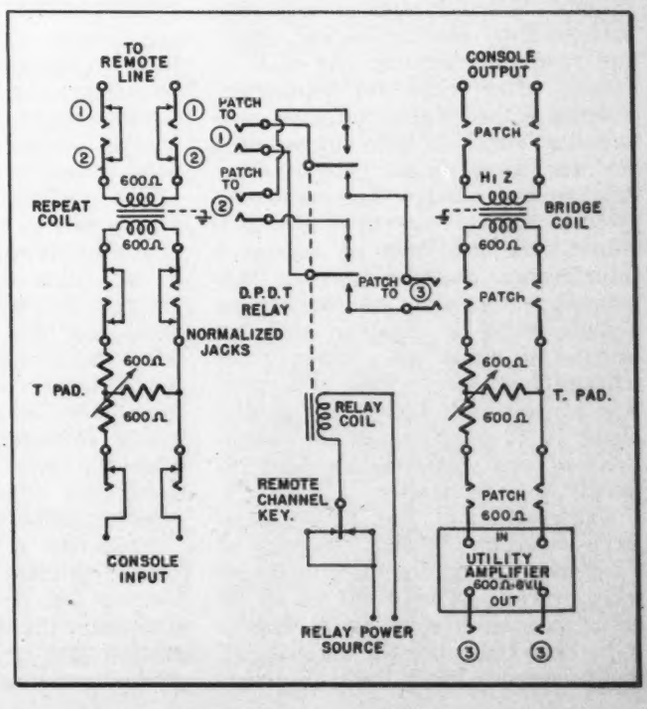
MANY broadcast station speech input consoles are equipped to feed a cue signal to a remote line just before the remote program takes the air. Also, most of the speech input console circuits use merely a repeat coil in the input. The degree of isolation is much improved if a 1 to 1 repeat coil followed by a pad is used in addition to the console input transformer. This makes it impractical to feed cue as provided for by the console manufacturer.

Therefore, a system was devised at WBBZ which simplifies cueing remotes. It consists of a relay wired to the patch panel, a spare set of contacts on the remote channel key, and a relay power source. Any utility amplifier, usually a part of station equipment, which has a 600 ohm, 8 V.U. output can be used. The remote channel switch is so connected that in the neutral position the relay is energized and connects the amplifier to the remote line. As soon as the cue line or word is passed (such as the time) the channel key is thrown, and the remote is on the air. This eliminates the necessity of using a telephone, or meeting a time previously set since the remote engineer will hear the air program and get a direct cue.

Also, all incoming remote lines are normalized, and should trouble develop in the relay circuit after the program is on the air, the patch plugs can be pulled out and the program continues. Should the relay power fail, the program would not be interrupted since the relay is de-energized while the remote is on the air.

This system has been in use here for over a year without incident. No special line check is necessary. This can be used only where there is no telephone company amplifier in the line.

(right) Remote cueing system uses improved modulation isolation methods.



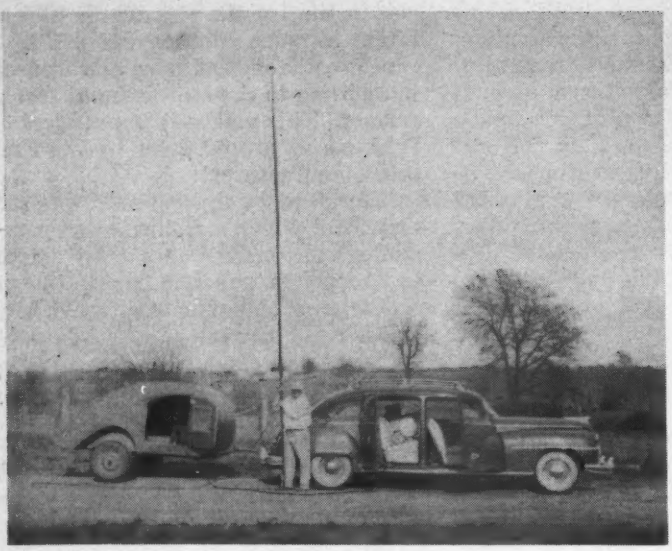


Fig. 6: Test car equipment and power trailer on location

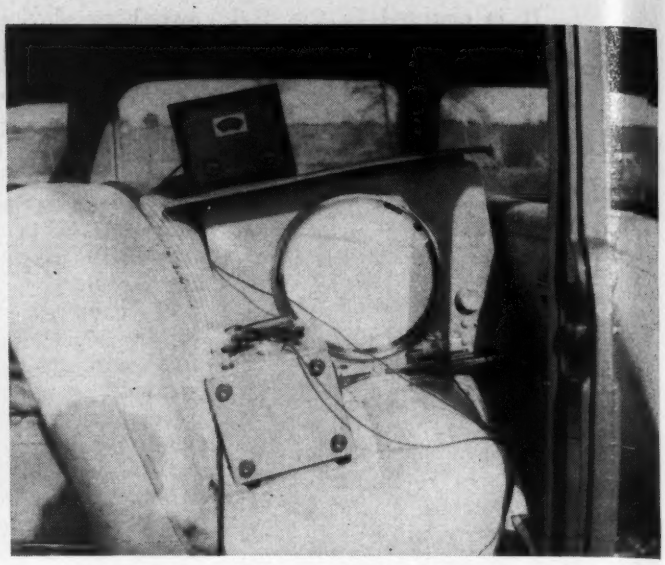


Fig. 7: Zenith TV receiver and converter for judging video quality

UHF TV Propagation

Comprehensive survey under typical broadcasting conditions using both commercial receivers and field strength measuring equipment provides new angles on UHF TV

THE mounting of the transmitting antennas allowed orientation only between 150-210°. It was therefore necessary to limit measurements to the area included between these extremes. Seven radials were laid out at intervals of 100. Test locations were selected along each radial, at intervals of 1 mile within built-up areas, and 2 miles beyond. These locations included empty lots and fields, parks, cemeteries and street and road intersections. At each location, after time for equipment warmup, the Yagi antenna was raised on the 20-ft. pole and oriented for maximum signal. The receiver AGC voltage and a description of picture quality were then recorded. Notes were also made of multipath interference, and the antenna was rotated to determine whether strong signals could be obtained with an orientation other than towards the transmitting site. This procedure was repeated at 4 or more points, about 10 ft. apart, to obtain indications of the variations in field intensity at each location.

Examination of Fig. 9 will show large variations in field intensity at many locations at distances under 10 miles, variations as great as 19 db being recorded in some cases. This is to be expected, since the majority of these locations lie in built up areas.

Radial	Ave. 2-10 mile elev.	Ant. height above 2-10 mile elev.	Min. elev.	Max. elev.
I	975 ft.	295 ft.	760 ft.	1080 ft.
II	952	318	760	1100
III	943	327	790	1110
IV	924	346	800	1160
V	890	380	710	1100
VI	880	390	795	1070
VII	866	404	750	1045

Small variations in measured field intensity were generally found at distances beyond 10 miles, where most of the locations are rural in character.

The profile curves were drawn on a true earth's radius basis, with an expanded elevation scale. The status of any point on the curves with respect to optical line of sight conditions may thus be obtained directly from the profiles. Data for profiles for distances under 15 miles were taken from topographical maps indicating contour intervals of 10 ft., while the remainder of the data was taken from other maps with contour intervals of 50 ft.

Inspection of the field intensity curves, indicates that the various profiles are similar in character, dropping below the elevation of the transmitting site at 1 to 2 miles, then gradually rising to maximum elevations of 1045 to 1160 ft. and (175 to 290 ft. above the transmitting site), finally dropping off near the ends of the radials in some cases. Details of the radials appear at left.

Method of Calculation of Field Intensity Versus Distance Curves.

For distances $d \gtrsim d_o$:

$$F'(50,50) = P' + 20 \log (137{,}600/d) + M(d,f)$$

Where $d_o = 2.31 \times 10^{-6}\ h_t'\ h_r'\ f_{MC}$

h_t' Height of the transmitting antenna above a plane tangent to the earth of 4/3 radius at the geometrical ray reflection point, feet (taken as 400 ft.)

h_r' Height of the receiving antenna above a plane tangent to the earth of 4/3 radius at the geometrical ray reflection point, feet (taken as 30 ft.)

f_{MC} Frequency (195 $_{MC}$)

P' Effective Radiated Power, db, above 1 KW (5.4 db)

d Distance from the transmitter site, miles

$$M(d,f) = d\left(0.072 + 0.001 f_{MC} - \frac{0.06 f_{MC} + 0.05}{d_o}\right)$$

For distances d, $d_o \gtrsim 15$ miles:

$$F'(50,50) = P' + S + M(d,f)$$

Where S Theoretical field intensity (taken from Figure 4, Appendix 4, "Standards of

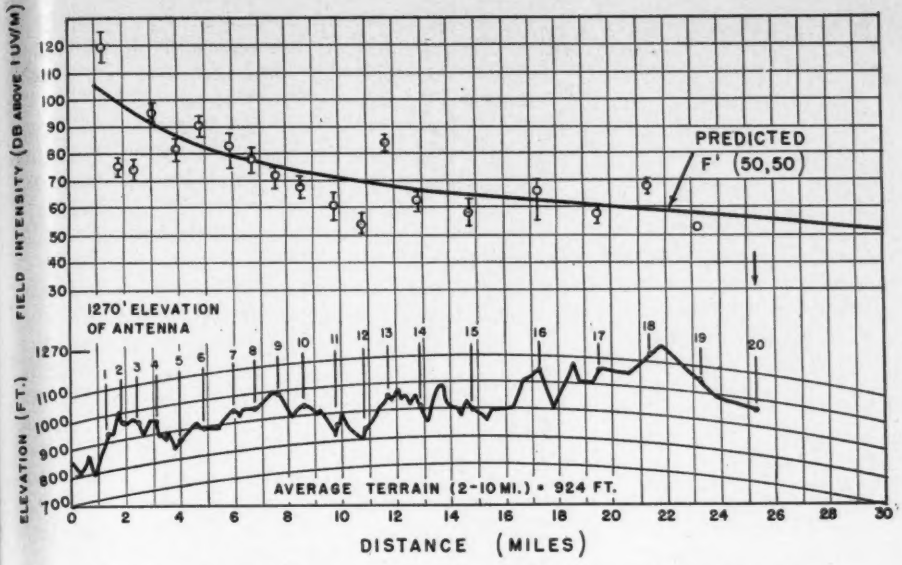


Fig. 9: Typical profile and field intensity plotted against terrain elevation

Measurements

PART TWO OF TWO PARTS

By ***KENNETH H. COOK,*** *Research Engineer*
ROBERT G. ARTMAN,* *Chief Television Engineer*
Midland Broadcasting Co., Kansas City, Mo.

Good Engineering Practice Concerning Television Broadcast Stations", December 19, 1945)

M(d,f) Correction to the theoretical field intensity (taken from the 195 MC curve of Figure 1, "Report of the Ad Hoc Committee", Volume I, May 31, 1949)

For distances $d > 15$ miles:

$$F'(50,50) = P' + F(50,50)$$

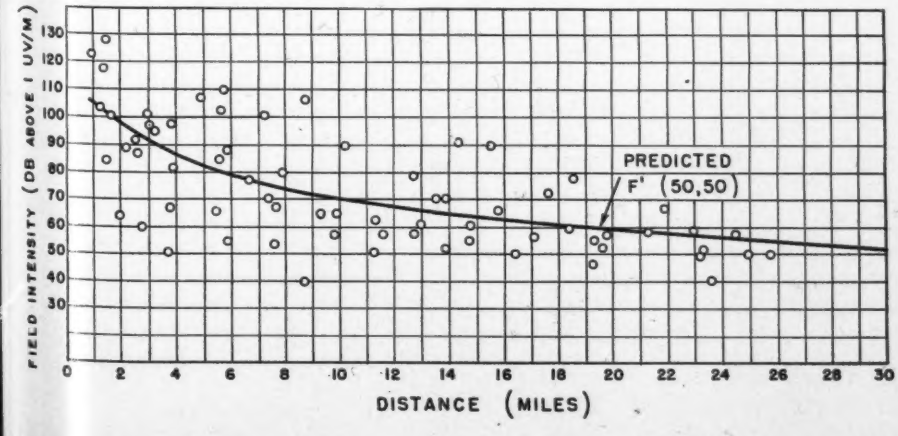
Where F(50,50) Tropospheric field intensity (Fig. 6, "Report of the Ad Hoc Committee", Vol. I, May 31, 1949)

The transmitting antenna height used in calculations for distances greater than d_o miles is the height above average elevation between 2 and 10 miles from the transmitting site along the pertinent radial.

The predicted F'(50,50) fields were calculated from 195 MC data, as proposed for channels 14-55 in the the "Notice of Further Proposed Rule Making". This document does not specify a procedure for calculation of F'(50,50) for distances under 15 miles, however, the procedure used in these cases is that specified in Volume I, of the "Report of the Ad Hoc Committee".

*Now television engineer for American Broadcasting Co., New York City

Fig. 8: Average measured field intensity plotted against distance for all radials



It should be noted that a receiving antenna height of 30 ft. was used in calculation of the predicted F'(50,50) field, while actual measurements were made with a height of 20 ft. The measured field intensities might be multiplied by a factor of 30/20 (3.5 db) to account for this discrepancy; but present knowledge of receiving antenna height-gain functions at these frequencies does not justify such a procedure. In fact, there is considerable doubt whether 30 ft. measurements would have yielded field intensities substantially greater than those obtained at 20 ft. The measured data is therefore compared directly with the predicted values.

In Fig. 8, the average measured field intensities on all radials are plotted against distance. An average predicted F'(50,50) curve is also included. This curve is an average, at any given distance, of the predicted F'(50,50) fields for all radials, and is substantially the same as would be calculated for a transmitting antenna height of 351 ft. above average 2-10 mile elevation (average height for all radials). Fig. 8 shows the large range in average measured field intensity obtained at approximately equal distances, this range being as great as 50 db in some cases, although the range between the predicted F'(50,50) fields for Radials I and VII (lowest and highest transmitting antennas) is of the order of only 3 db.

Average terrain distribution factors for the area over which the measurements were made may be determined from Fig. 4 by use of the relation:

$$R(L) = F'(L,50) - F'(50,50)$$

where R(L) is the terrain distribution factor for L% of the locations

F'(L,50) is the field intensity exceeded at L% of the locations, 50% of the time.

The terrain distribution factors thus obtained are shown in Fig. 10. It will be noted that the terrain factor obtained for 70% of the locations is —7 db, and for 90% of the locations, —17.5 db. These figures are in fairly close agreement with the factors of —6 db and —15 db proposed by the Federal Communications Commission.

Estimates of the service radii for various grades of service and various powers were then made. In Appendix B of the "Notice of Further Proposed Rule Making", the FCC specified local field intensity requirements

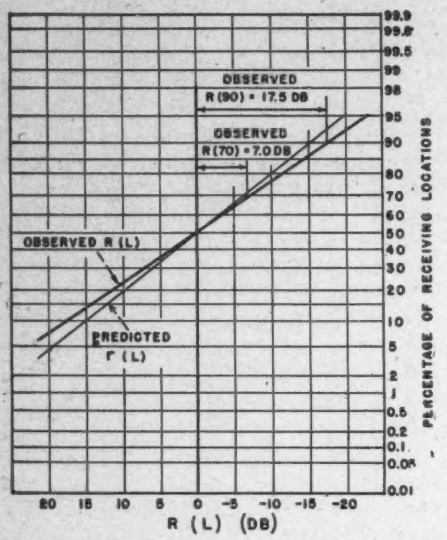


Fig. 10: Observed and predicted terrain factors (R(L)) for L% of the sites

of 65 db (above 1μ v/m) for Grade A and B service, and 60 db for Grade C service. These figures specify the local field intensity required at 600 MC to give an r-f signal-to-noise-ratio (peak visual carrier/rms noise) of 30 db, when the receiving system consists of a receiver with a noise figure of 15 db, an antenna with a gain of 8 db in Grade A and B service area and 13 db in Grade C service areas, and a transmission line with a loss of 5 db. Median, or F′(50,50) field intensities required for the various grades of service are then calculated as follows:

	Grade A	Grade B	Grade C
Local field intensity	65 db	65 db	60 db
Terrain factor	15 db	6 db	0 db
Time factor	0 db	3 db	2 db
Median field intensity	80 db	74 db	62 db

The resulting service radii for various powers and for an antenna height of 351 ft. are:

	10 db (10 kw)	13 db (20 kw)	23 db (200 kw)
Grade A	7.9 mi.	9.4 mi.	17.4 mi.
Grade B	11.4 mi.	13.6 mi.	25.2 mi.
Grade C	23.0 mi.	26.4 mi.	39.0 mi.

Estimating Service Radii

Estimates of service radii for various powers may also be made for transmitting antenna heights of 500 feet. These radii, based entirely on FCC proposals in Appendix B of the "Notice of Further Proposed Rule Making" are as follows:

	10 db (10 kw)	13 db (20 kw)	23 db (200 kw)
Grade A	10 mi.	12 mi.	21 mi.
Grade B	14 mi.	17 mi.	29 mi.
Grade C	27 mi.	31 mi.	43 mi.

while corresponding estimates obtained from calculations based on the results of the measurements described in this report are:

	10 db (10 kw)	13 db (20 kw)	23 db (200 kw)
Grade A	7.0 mi.	8.5 mi.	16.0 mi.
Grade B	11.0 mi.	13.5 mi.	24.3 mi.
Grade C	24.3 mi.	28.0 mi.	41.0 mi.

These radii are lower than those obtained from calculations based entirely on FCC proposals, by approximately 25% for Grade A service, approximately 20% for Grade B service, and approximately 10% for Grade C service.

The service radii for radiated powers of 13 db and 23 db are of particular interest, the former, because 13 db is approximately the maximum radiated power obtainable with presently available equipment, while the latter is the maximum radiated power which the FCC proposes to authorize for use in the ultra-high-frequency channels. Since the FCC does not propose to authorize this maximum radiated power for antenna heights in excess of 500 ft., the 23 db, 500-ft. radii represents a "ceiling" on the service range of an ultra-high-frequency station.

The service radii actually obtained in this survey are not produced by any of the foregoing estimates, since the characteristics differ from the system previously assumed. The noise figure of the converter was approximately 20 db, and antenna gain was 6.3 db with a transmission line loss of 2.5 db. The local field intensity required at 507.25 MC for an r-f signal/noise ratio of 30 db is thus 2.7 db greater than previously assumed for Grades A and B service; and 7.7 db greater for Grade C service. The median field intensity (based on the results of the measurements described in this report) required for the various grades of service, and the resulting service radii for a radiated power of 5.4 db and an antenna height of 351 ft., are given below:

	Median Field Intensity	Service Radii
Grade A	87.7 db	3.5 mi.
Grade B	80.2 db	5.9 mi.
Grade C	72.2 db	9.6 mi.

Multipath interference of some degree was noted at 12 of the 130 measuring locations, but in only 5 of these locations was it of a serious nature. In some cases, fairly strong signals could be obtained by orienting the receiving antenna in a direction other than towards the transmitting site, indicating that more multipath interference might have been observed had a less directive receiving antenna been employed. It was not believed that these observations were of great value, however, due to the directional characteristics of the transmitting antennas used. In particular, possible serious multipath interference due to reflections from various tall downtown buildings, close to the transmitting site, was rendered ineffective, since little, if any, signal was radiated in the direction of these buildings.

Quality Analysis Difficult

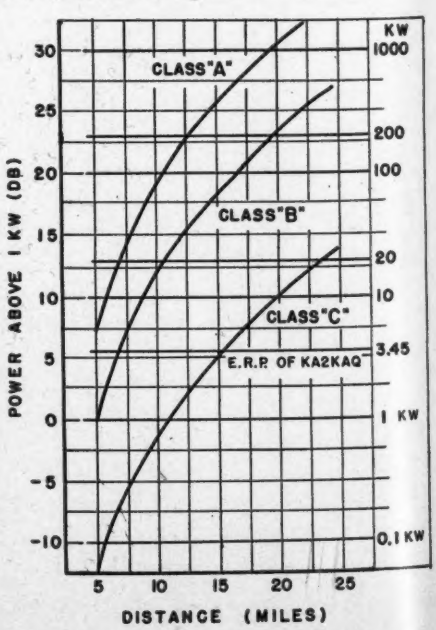
Analysis of the relative picture quality information recorded during the course of the survey was rather difficult as the classifications represent the opinion of only 2, or at most, 3 observers, and the picture was not viewed under normal viewing conditions.

Mileage Interval	Picture Quality: Poor or better	Fair or better	Good or better
0-5 miles	95%	87%	70%
5-10 miles	91%	68%	35%
10-15 miles	68%	41%	27%
15-20 miles	59%	18%	0%
Over 20 miles	25%	15%	10%

In order to place the relative picture quality descriptions on a more definitive basis, the approximate field

(*Continued on page* 82)

Fig. 11: Observed power requirements for various FCC grades of service



WASHINGTON
News Letter

Latest Radio and Communications News Developments Summarized by TELE-TECH's Washington Bureau

PROCUREMENT & TRAINING MAJOR 1951 TASKS—The armed services, in their 1951 goals in the communications-electronics-radio field, have two major tasks—procurement and intensive training of electronics-radio specialists, both commissioned and enlisted personnel. So the selection of the new Chief Signal Officer of the Army to succeed Maj. Gen. S. B. Akin, who has held that key post during the past four years, and has guided the helm of the Signal Corps in the difficult, economy-riddled postwar period, is all important for the successful achievement of these two assignments. Maj. Gen. Francis L. Ankenbrandt, Director of Air Force Communications, is remaining on that post, while Rear Admiral John R. Redman, Director of Naval Communications, will undoubtedly not be shifted to a new assignment until next fall.

THREE GENERALS UP FOR CHIEF SIGNAL OFFICER—Although this was written before any final determination has been made by the Department of the Army as to the new Chief Signal Officer, there are three outstanding major generals of the Signal Corps whose names were slated to be transmitted to President Truman for consideration for nomination to the U. S. Senate to become the next Chief Signal Officer for the next four years.

GENERAL REEDER FAVORED—The general who is regarded as having rather an "inside track" at TELE-TECH's press deadline is Maj. Gen. William O. Reeder, now serving as first Deputy Assistant Chief of Staff of the Army for logistics and procurement. General Reeder is eminently qualified to direct the two upcoming major tasks of the Signal Corps, because he is rated probably the Army's best authority on procurement matters. During World War II, he commanded the Signal School at Fort Monmouth, N. J., during the period of the first three years when training of Signal Corps specialists was a number one job.

GENERALS MATEJKA AND LANAHAN—The other two are also exceptionally well qualified in these fields—Maj. Gen. Jerry V. Matejka, who is at present military director for production management of the Munitions Board, and previously was Chief Signal Officer of the European Command; and Maj. Gen. Francis H. Lanahan, the highly able commandant of the Fort Monmouth Signal Center, the largest field establishment of the Signal Corps, who during the war was Assistant Chief Signal Officer at General Eisenhower's SHAEF in Europe.

RAPID STEPUP IN TRAINING SINCE KOREAN WAR—The Korean war has resulted in a very sharp stepup in the technical and operational training of the commissioned officers and enlisted personnel of the Air Force, Signal Corps, Naval Communications and Airways and Air Communications Service because it is fully recognized that the modern, complex communications and electronics equipment requires well trained personnel for efficient and proper operation in the combat theater.

INCREASE IN SCHOOL AND CLASSES—The Signal Corps has doubled the capacity of its three training schools from 6200 to 12,000. The U. S. Air Force Communications Directorate rapidly expanded its training programs and realigned the experienced personnel in the United States at the various Air Force training centers for the role of instructors. Naval Communications, in order to get experienced personnel in communications and radio, established two communications schools right after the Korean fighting began, and a new "radioman" school is being established at the Navy Training Center at Bainbridge, Md., while a refresher course for communications officers has been provided at the General Line School at Monterey, Cal. The AACS is now training more than 10,000 communications airmen, which represents more than 50% of the personnel strength of the AACS.

COY MAY SEEK REAPPOINTMENT—Even though he may face a very stiff fight on Senate confirmation, FCC Chairman Wayne Coy is now understood to have changed his mind on not seeking reappointment for a seven-year term at the helm of the Commission. Chairman Coy as the spearhead of the color television imbroglio will in the event of his reappointment by President Truman undoubtedly encounter stiff opposition in the Senate for carrying the torch on the mechanical color-video decision. His term for the FCC expires next June 30. Chairman Coy is said to feel he should not "run from this fight."

MUNITIONS BOARD EXPEDITING WORK VALUABLE—Exceptionally constructive work in the location and expediting of important critical materials and metals for electronic-radio manufacturers to produce essential apparatus and equipment for the armed services has been accomplished by the Munitions Board's Electronics Division, headed by Marvin Hobbs. In fact, Mr. Hobbs and his deputy chief, Thomas Perrott, who served in a key capacity in this field for the Signal Corps during the war, took on this assignment as an extra duty for the Electronics Division.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington, Editor

IRE NEW PRODUCTS (Continued)

Frequency Converter Accessory

The Type 2-7A Univerter, a frequency converter accessory having unity gain, is designed for use with the type 202B

FM signal generator to provide frequency coverage from 0.1 MC to 55 MC. Since the type 202B FM signal generator covers a frequency range from 54 to 216 MC this combination of instruments permits continuous coverage from 0.1 MC to 216 MC. The 207A Univerter is provided with a frequency increment dial which is calibrated in increments of 5 KC from plus 300 KC through zero to minus 300 KC. This permits making selectivity measurements on narrow band receivers. The r-f output voltage across a 53 ohm load connected at the unity gain jack is continuously variable from 0.1 microvolt to 0.1 volt by means of the 202B signal generator attenuator. The gain is constant within ± 1 db over the entire frequency range of the instrument.—**Boonton Radio Corp., Boonton, N. J.**—TELE-TECH

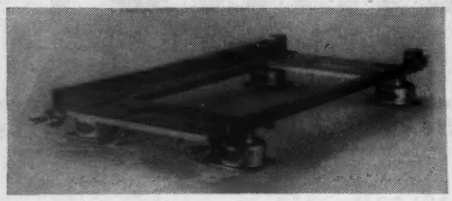
Voltmeter

Model 310A is the latest development in the field of sensitive, wide-range, wide-band voltmeters. It has been spe-

cifically designed for an extremely broad variety of needs such as, low level vibration measurements, microphone and phonograph studies, audio amplifier tests, carrier telephone transmission, ultrasonic development and AM broadcast band signal measurements. It has a resistance-capacity decade attenuator, a high gain negative feedback stabilized amplifier, a rectifier and a logarithmic indicating meter responding to the average values of the voltage wave but calibrated in RMS values of a sine wave. Its frequency range is from 10 cps. to 2 MC and its voltage range from 100 microvolts to 100 volts all read on a single logarithmic voltage scale by means of a six decade range switch. Its accuracy is 3% up to 1 MC and better than 5% up to 2 MCs. Its input impedance is 2 megohms shunted by 8 mmfds. on the less sensitive ranges and shunted by 15 mmfds. on the other ranges.—**Ballantine Laboratories, Inc., Boonton, N. J.**—TELE-TECH

Mounting Base

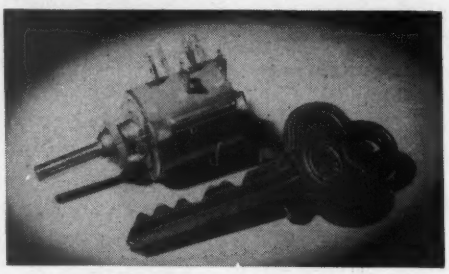
A new all-metal, all weather vibration and shock mounting base has been designed to meet specifications of JAN-C-



172A and AN-E-19. It is part of the series 831 unit suspension mounting bases. The resilient material used in the base is MetL-Flex, which makes it impervious to extremes of temperature and particularly adaptable to the exacting needs of today's high performance military and commercial aircraft.—**Robinson Aviation, Inc., Teterboro Air Terminal, Teterboro, N. J.**—TELE-TECH

Volume Controls

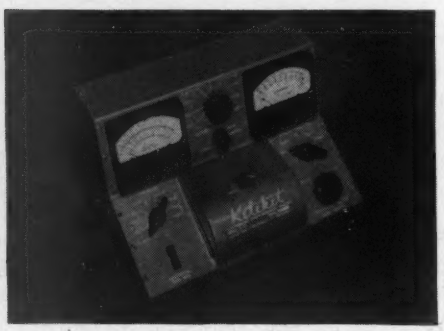
Series 48 composition-element subminiature controls are fit companions for sub-miniature tubes in ultra-compact



assemblies. Each unit, housed in a yellow low-loss bakelite case, measures only 5/8 in. in diameter by 3/8 in. deep. Two units can be nested together and held by metal straps for a dual-control combination. They are available in resistance values up to 3 megohms linear, and in tapers up to 1 megohm. Round or slotted shafts are available, and also a shaft-locking arrangement. Despite greatly reduced size, these Clarostat subminiature controls are ruggedly built for dependable service—**Clarostat Manufacturing Co., Dover, N. H.**—TELE-TECH

Electrometer Tube Analyzer

The K-50 electrometer tube analyzer is a carefully-constructed instrument, especially designed for testing electrom-



eter tubes as well as for measuring insulation resistance and hi-meg resistors used in radiation instruments. It is the only instrument of its kind, and features book-type cabinet construction for easy servicing. By following a simple, step-by-step procedure, direct readings of grid current, transconductance, and leakage resistance of electrometer tubes can be obtained. Thus a complete test of the tube can be made, which will indicate not only whether the tube is at fault, but also in what way. Measurements and ranges are: grid current, 0-10 x 10^{-14} amperes (1 range); transconductance, 0-200 micromhos (1 range); leakage resistance. 8 x 10^6 orms to 3 x 10^{15} ohms (7 ranges).—**Kelley-koett Instrument Co., 930 York St., Cincinnati 4, Ohio**—TELE-TECH

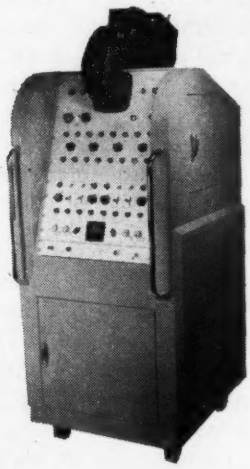
Vibration Meter

The MB M1 Vibration Meter was designed for use with the MB type 124 or 126 pickup to provide industry with a

high precision portable instrument to directly read steady state acceleration, velocity and displacement. It consists of an adjustable attenuator, an amplifier, and a direct reading indicating meter. When used with the MB type 124 vibration pickup the unit provides a meter reading proportional to the velocity of vibratory motion. An integrating network converts this output, when desired, to meter reading proportional to displacement and a differentiating network converts this output, when desired, to a meter reading proportional to acceleration. The type of response is selected by a three-position switch whereby the acceleration, velocity and displacement of a body can be measured independently.—**The MB Manufacturing Co., Inc., 1060 State St., New Haven, Conn.**—TELE-TECH

Strain and Stress Tester

A completely self-contained and modernized electronic instrument for the study of vibration, strain and dynamic

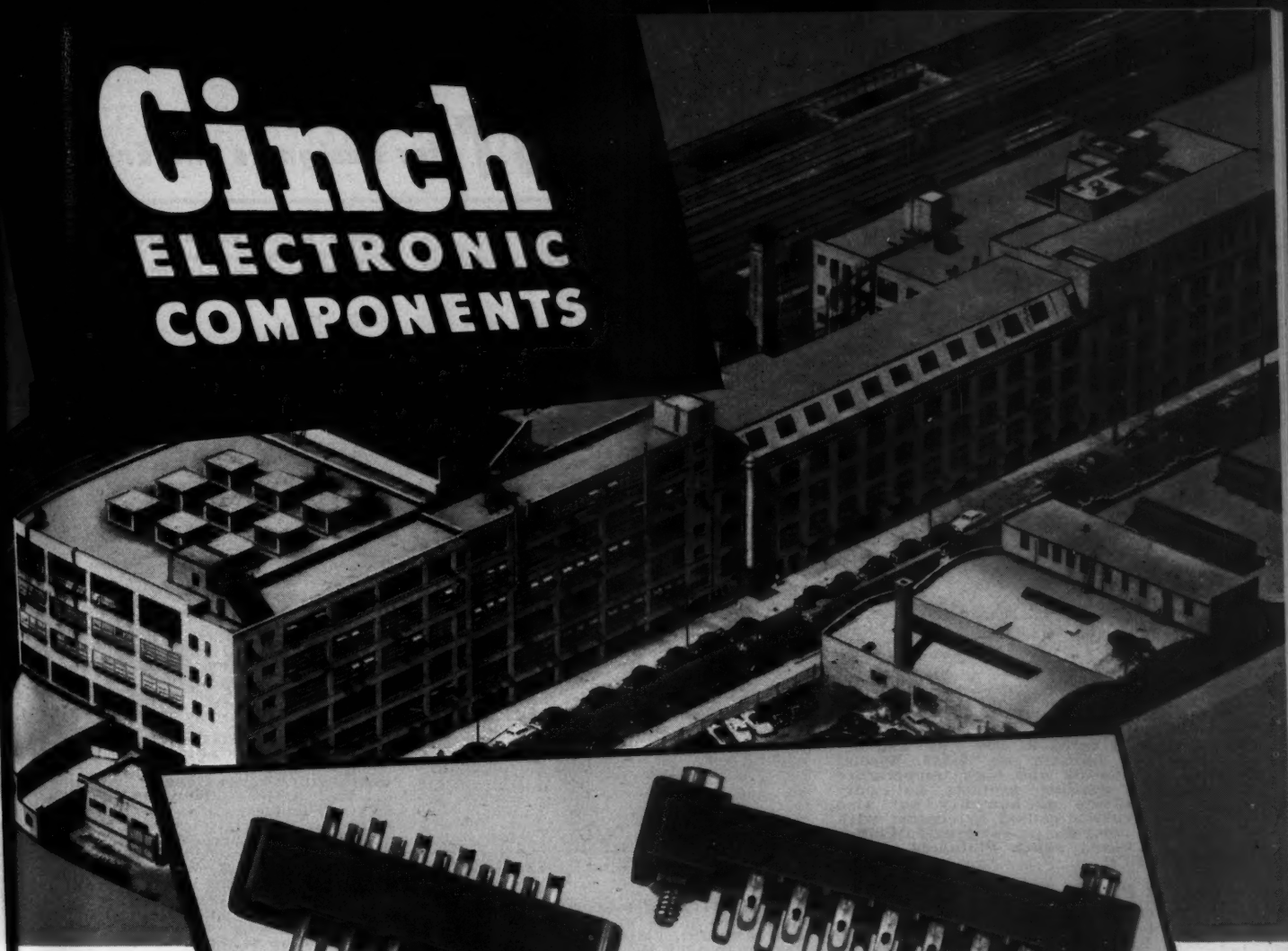


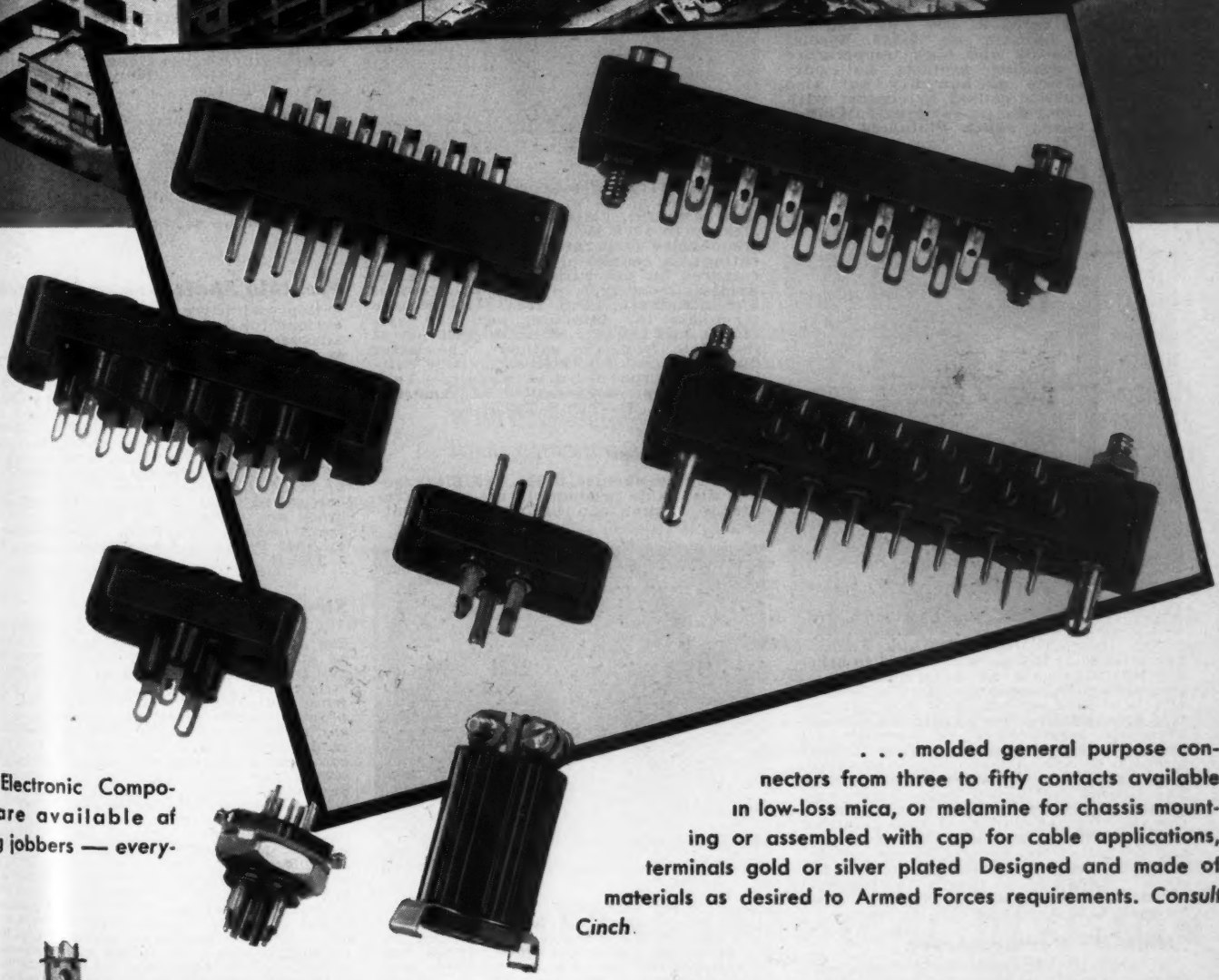
stresses has been developed. Known as the H-42A Strainalyzer, the unit records phenomena up to 50 KC and amplifies these weak signals up to 35,000 times. It makes possible the simultaneous observation and recording of four separate traces on a single 5-in. oscilloscope tube, each appearing in correct time relationship without the necessity of optical alignment. Recording is accomplished with a Fairchild Oscillo-Record camera. —**Electronic Tube Corp., 1200 East Mermaid Ave., Philadelphia, Pa.** — TELE-TECH

Crystals

A new series of Crystals, known as the "G" Series, employs a glass envelope for absolute hermetic sealing. Through the use of glass, instead of conventional metal holders, a dependable vacuum can be maintained. This results in higher crystal Q and absolute freedom from the effects of supersonic reflections. Although these new crystals are now available only in limited quantities and only in the 90 to 200 KC range (the JK G-9), it is planned to expand production and use this mounting on higher frequencies as well. Excellent thermal insulation is afforded by the glass vacum, utilizing the principle of the thermos bottle.—**James Knights Co., Sandwich, Ill.**—TELE-TECH

Cinch
ELECTRONIC COMPONENTS





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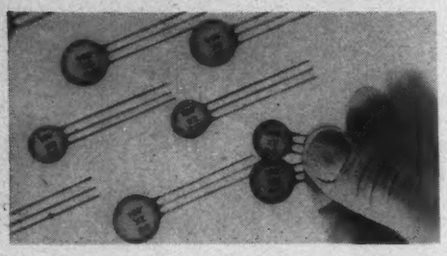
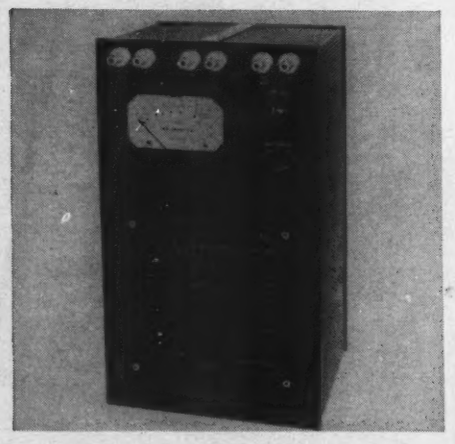


aturized equipment, is now available in the Tiny Mike series. There are five basic types available in this series. These are: Type 2 TM, ¼ in. diameter, single capacity units from 500 to 1,000 mmfd. at 500 v.dc. described in bulletin No. 2-610; type 6 TM, 19/32 in. diameter, single capacity units from 50 to 5,000 mmfd at 500 v.dc. described in bulletin No. 2-611; type 8 TM, ¾ in. diameter, with a capacity rating of 10,000 mmfd. (8TM5S1C) at 500 v.dc. described in bulletin No. 2-612; type 6 TM, 19/32 in. diameter dual capacity units (from 2 x 100 to 2 x 10,000 mmfd.), all rated at 500 v.dc. and described in bulletin No. 2-613. Special phenolic coating and high temperature wax impregnation protects not only against effects of humidity but also against grounds caused by contact with nearby components. — **Cornell-Dubilier Electric Corp., South Plainfield, N.J.**—TELE-TECH

Output Power Meter

Type OP-962 output meter has been designed to measure the actual power delivered by an audio signal system to a



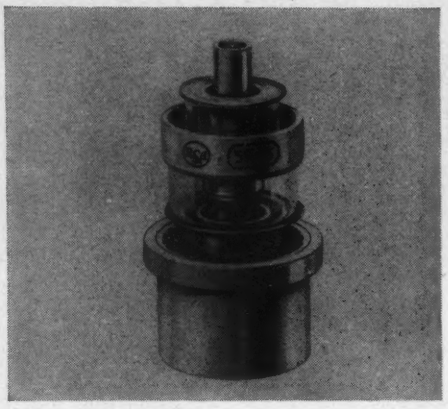
given load. It is also well suited to other applications such as determination of characteristic impedance of an ac source, effects of load variations on a signal system, transmission line equalization measurements, measurement of insertion loss in multi-channel mixer and other complex circuits, filter and transformer measurements, and radio receiver measurements. The OP-962 features a large meter with resulting ease in reading, provision for the use of a calibrated external amplifier to extend the power range below 0.1 mw, and provision for connecting an oscilloscope to observe the wave shape of the signal. Range of 0.1 mw to 100 watts is covered.—**Daven Co., 191 Central Ave., Newark 4, N. J.**—TELE-TECH

"High-H" Permeameter

A "high-H" Permeameter for magnetic testing, similar to the instrument originally built and described by Sanford and Bennett at the National Bureau of Standards is suitable for exact measurements of normal induction, hysteresis and other characteristics of magnetic materials which require magnetizing forces up to more than 5000 oersteds. Outstanding features of the instrument are: small specimen size, direct-reading calibration system; remotely controlled flip-coil system for measuring H; double H-coil for simple extrapolation to surface of specimen, means for positioning of specimen in horizontal, vertical, and lateral directions by calibrated screw adjustments; remotely controlled reversing switch in magnetizing circuit; no special cooling system required.—**Rubicon Co., Dept. E, Ridge Ave. at 35th St., Philadelphia 32, Pa.**—TELE-TECH

Power Triode

A new, very compact, forced-air-cooled power triode has been designed for uhf plate-pulsed oscillator and amplifier



service. It has a maximum rated plate dissipation of 250 watts, and can be operated with full plate voltage at frequencies up to 1300 MC. Operation at higher frequencies is permissible with reduced ratings. A coaxial-electrode structure is featured for use with circuits of the coaxial-cylinder type. The design provides low-inductance, large-area, r-f electrode terminals for insertion into the cylinders, and permits effective isolation of the plate from the cathode. The latter feature makes the 5946 particularly suitable for grounded-grid circuits.—**Tube Dept., Radio Corporation of America, Harrison, N. J.**—TELE-TECH

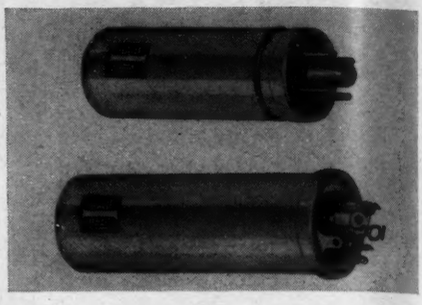
Treble Filter

Annoying surface noise and disagreeable distortion products in the upper frequency ranges can be virtually elimi-

nated with minimum loss of useful-treble frequencies, by means of the new OA-1 adjustable 5-range treble filter. 10 KC whistles and other heterodynes can be eliminated on AM broadcasts, and quick adjustment made on FM to correct for poor recordings and transcriptions as well as high-range microphone distortion. Original treble control arrangements of the equipment with which the filter is used retain full usefulness to boost or attenuate within the treble range selected.—**Berkeley Custom Electronics, 2216½ Grant St., Berkeley 3, Calif.**—TELE-TECH

Electrolytic Capacitors

A new and improved line of plug-in and twist-prong electrolytic capacitors has been developed to meet the most



exacting commercial and JAN specifications. Built for the most rugged service to which an electrolytic can be subjected, they feature a completely new phenolic molded cap structure that hermetically seals the container. Hermetic seal, employing molded-in terminals, is so perfect that these units can be used for the most difficult conditions encountered, from adverse marine operations to stratosphere use. They are also immune to sudden temperature and barometric changes, and built to withstand wider temperature ranges than ordinarily associated with electrolytics. They meet all Navy and Air Corps requirements, are available for high or low voltage requirements, or both. Economy in mass production allows complete distribution, without additional cost, for civilian TV and usual electronic applications as well as new and replacement service in aircraft, fire, police and related emergency services.—**Illinois Condenser Co., 1616 North Throop St., Chicago 22, Ill.**—TELE-TECH

Flexible Shaft Remote Control

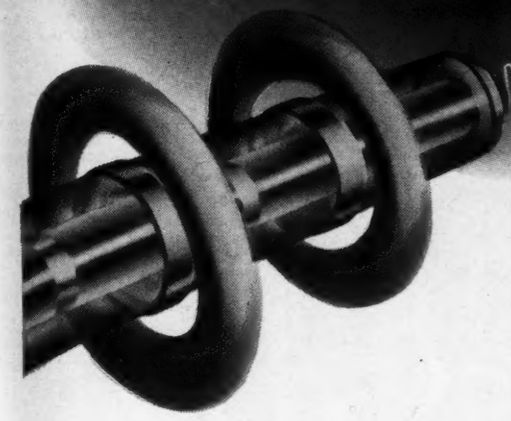
Representative of the many new applications for flexible-shaft couplings in the aircraft, radar, and instrumentation fields is the illustrated non-magnetic type for the control of permanent-magnet type focusers for television tubes. The reluctance of the magnetic circuit is varied by a sliding steel collar controlled by a lead screw at the output end of the flexible shaft. The flexible shaft is formed of high-strength bronze, and sometimes is enclosed within an insulating plastic or braided cotton sleeve. While normally controlled from the rear of the set, some units are designed to operate from the front panel.—**Kupfrian Manufacturing Co., 541 Prospect Ave., Binghamton, N. Y.**—TELE-TECH

Sweep Generator

A new wide band sweep with markers for aligning radar i-f amplifiers, known as the Rada-Sweep, displays amplitude vs. frequency response on standard oscilloscopes. It increased production speed when substituted for conventional CW point-by-point methods. Wide band linear sweep is available. The Rada-Sweep is designed specifically for producing a constant amplitude frequency modulated signal for exploring the frequency response of radar i-f amplifiers. Sweep is wide band and the center frequency may be switched to center of pass band of present amplifiers. Simple design change makes other center frequencies available. Frequency marks of pulse type are connected directly to oscilloscope and are not affected by i-f amplifier under test. These marks are controlled by front panel switches which turn them on or off individually. Marks at any specified frequency can be supplied and frequency is changed by changing plug-in crystals. A wide or narrow sweep may be selected by front panel switch. Center frequencies are switchable to 30 or 60 MC. Fine tune control is available for center pattern. Wide band sweep width is 20 MC. Narrow band width is 3 MC. There are pulse type crystal positioned markers at 25, 35, 55, 65 MC. Output is up to 0.5 volt into 70 ohms.—**Kay Electric Co., 14 Maple Ave., Pine Brook, N. Y.**—TELE-TECH

The Remarkable New Dielectric Gas

SULFUR HEXAFLUORIDE SF_6



For Transformers—Co-axial Cables—

Capacitors—and other High Voltage Equipment.

Some practical advantages of Sulfur Hexafluoride:

1 Permits operation at higher voltages or lower pressures than are possible with air or nitrogen; i.e. increased voltage at the same pressure, or the same voltage at reduced pressure.

2 Reduces or eliminates corona.

3 Offers opportunity for simplified design and reduced dimensions of equipment; also lower construction and maintenance costs occasioned by lower pressure required.

4 Makes it possible to maintain voltages over greater distance in cables with lower power loss.

5 Has minimum permanent or cumulative effect in event of breakdown.

6 Is non-flammable.

WHEREVER A GASEOUS OR LIQUID DIELECTRIC has application, General Chemical Sulfur Hexafluoride merits prompt investigation. This remarkable new insulating gas has a dielectric strength comparable to that of mineral oil at moderate pressures! With it, operating efficiency can be stepped up in many types of electrical equipment, while overall construction and maintenance costs may often be lowered.

GENERAL'S Sulfur Hexafluoride is an extremely pure material that meets the most exacting dielectric requirements: it is remarkably inert; possesses exceptional thermal stability, and has a dielectric strength substantially higher than that of air or nitrogen.

For commercial quantities or more detailed technical information, consult General Chemical's Product Development Department. Please use business letterhead when writing.

SULFUR HEXAFLUORIDE

Formula: SF_6
Molecular Weight: 146.06
Melting Point: —50.8°C
Sublimation Temperature: —63.8°C
Critical Temperature: 45.6°C
Critical Pressure: 540 p.s.i.a.
Vapor Pressure:

Temp. (°C)	Pressure (p.s.i.a.)
—80	5 (subl. press.)
—50	34
—20	102
+10	240
+40	481

60 cycle Dielectric Strength (tungsten rod and 1" diam. sphere, 1" spacing)

	Pressure, p.s.i.g. 0	10	20	30
Sulfur Hexafluoride, kilovolts	70	107	120	122
Nitrogen, kilovolts	13	17	21	25

BASIC CHEMICALS
GC
FOR AMERICAN INDUSTRY

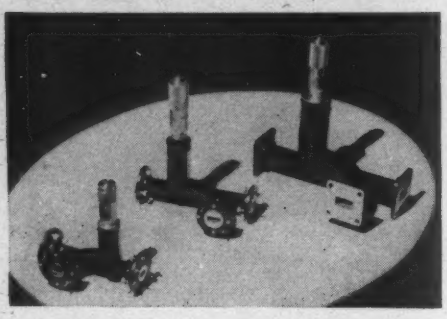
PRODUCT DEVELOPMENT DEPARTMENT

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo Charlotte • Chicago • Cleveland • Denver • Detroit • Houston • Jacksonville Los Angeles • Minneapolis • New York • Philadelphia • Pittsburgh • Providence San Francisco • Seattle • St. Louis • Yakima (Wash.)
In Wisconsin: General Chemical Company, Inc., Milwaukee, Wis.
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

Cavity Frequency Meters

Designed for transmission and absorption indications, a trio of new cavity frequency meters may also be used for

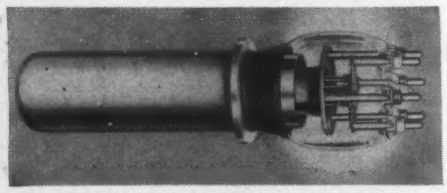


setting oscillators and signal sources to a predetermined frequency with an accuracy of 0.1%.

Frequency ranges are: model 348, 13,000 to 18,000 MC; model 349, 19,000 to 26,000 MC; model 350, 26,500 to 39,000 MC. Each model consists of a cylindrical cavity with one end joining the broad side of a standard section waveguide. Coupling between the cavity and the waveguide is obtained by means of an iris in the center of the junction. The cavity is tuned by a plunger which is diven by a micrometer head. Folded half-way traps are used in place of sliding contacts between the plunger and the cavity wall to eliminate erratic behavior and maintain calibration accuracies.—**Sperry Gyroscope Co., Great Neck, N. Y.**—TELE-TECH

Triode

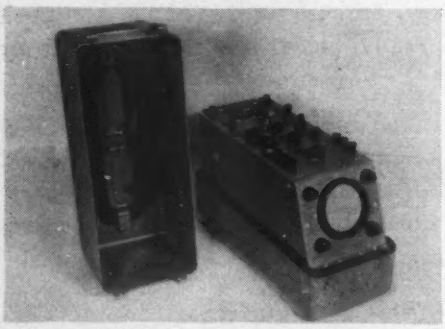
Designated as the F-5918, a new triode has been developed for use as an r-f amplifier, oscillator, or class B modu-



lator. The heavy-wall, high-conductivity anode is water-cooled and is capable of dissipating 60 kw in continuous commercial service. It weighs approximately 25 lbs. A multi-strand filament of thoriated tungsten permits hairpins to expand individually and tends to eliminate stresses that might cause filament warping. Kovar glass-to-metal seals are used throughout to provide a mechanically rugged structure.—**Federal Telephone and Radio Corp., 100 Kingsland Road, Clifton, N. J.**—TELE-TECH

Miniaturized Oscilloscope

Features usually found in large precision laboratory oscilloscopes are characteristic of a new miniaturized oscillo-



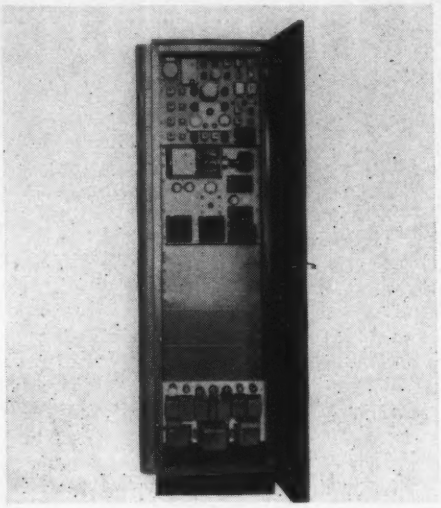
scope developed with a sweep frequency range from 3 cps to over 50 KC. Vertical amplifier response is flat within 3 db from direct current to 2 MC, while horizontal response is flat within 2 db from dc to 100 KC. Faithful reproduction of wave forms with 3 μ sec. rise times and 100 KC square waves is provided. Overshoot or ringing are absent when used with these pulse type wave forms at all settings of the compensated attenuator. —**Hycon Manufacturing Co., 2961 East Colorado St., Pasadena 8, Calif.**—TELE-TECH

Selenium Rectifier Cartridges

High voltage selenium rectifier cartridges with voltage ratings up to 25,000 v. per cartridge and current ratings up to 75 ma have been developed. These cartridges utilize five different selenium cell sizes varying from ⅛ in. in diameter up to 1 in. in diameter with corresponding current ratings varying from 1.5 ma up to 75 ma. They are designed to meet rigid humidity, altitude, vibration and shock specifications and they can be operated over the temperature range of —55° C to 100° C.—**International Rectifier Corp., 6809 South Victoria Ave., Los Angeles 45, Calif.**—TELE-TECH

Microwave Link

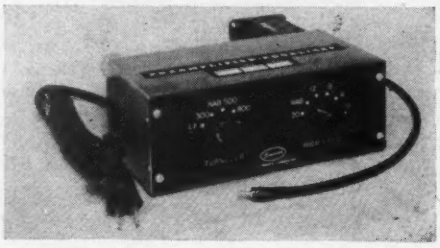
Type BTL-A studio-transmitter link equipment provides highly directive point-to-point transmission of uniform



quality between studio and transmitter sites of broadcast stations. It consists of a transmitter, receiver, and two 48-in. parabolic reflector antennas. Basically it provides a unidirectional program channel, with service in the 890-911 MC band for TV, 925-940 MC for AM, or 940-952 for FM. The transmitter includes a modified version of the RCA "Direct FM" exciter unit. Its output of approximately 50 MC requires only one stage of doubling, followed by two stages of tripling to provide the carrier frequency. A crystal-controlled double superhetrodyne receiver constitutes the receiving end of the link. Furnished with a self-contained power supply and housed in a 19-in. chassis, it requires only 12½ in. of panel space.—**Radio Corporation of America, RCA Victor Div., Camden, N. J.** —TELE-TECH

Preamplifier-Equalizer

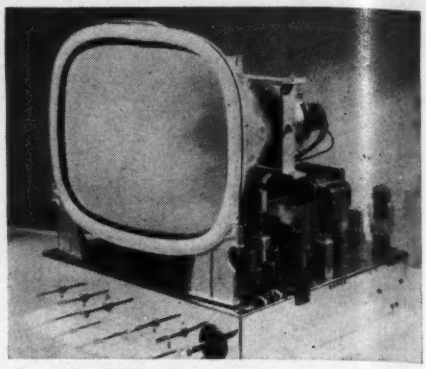
Model A65 preamplifier-equalizer is a flexible compact, high-quality equalized preamplifier which can be used with



constant-velocity (magnetic or dynamic) pickups having outputs as low as 10 mv. It affords exact compensation for widely varying recording characteristics. Screwdriver-adjusted gain control sets gain to suit pickup used. The unit has low output impedance, 20,000 ohms, and facilitates use of longer cable for output without loss of highs. It incorporates new 12AY7 low-hum, non-microphonic dual triode for initial stages; 6C4 for output stages. Power socket fits under 6L6 or 6V6 output tubes. Special socket is available for triode amplifiers.—**Brociner Electronics Laboratory, 1546 Second Ave., New York 28, N. Y.**—TELE-TECH

TV Mounting Ring

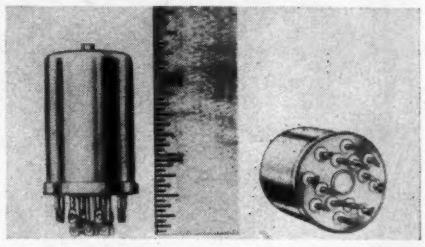
A new type mounting and insulating ring and sleeve for the 17-in. rectangular metal tube has been developed. Al-



though they incorporate several major improvements in their design, the ring and sleeve are similar to those being supplied to almost all major U. S. TV manufacturers. Specially engineered models are available for all round and rectangular metal picture tubes.—**Anchor Industrial Co., 533 Canal St., New York 13, N. Y.**—TELE-TECH

Miniature Relay

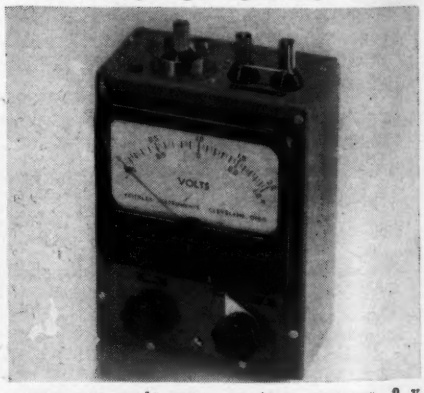
A new hermetically-sealed miniature relay has been developed which will withstand shocks up to 50 G and operate



in temperatures ranging from —65° to +200°. Displacing only 1.5 cubic in. and weighing 3.5 oz. sealed with a dry, inert gas, pressure filled, it has variable mounting arrangements. Contact ratings are: 2 amps, 28 v. dc; 2 amps, 115 v. ac, 400 cps. Overload rating is 12 amps., 28 v., 20 sec.; coil resistance is 300 and 150 ohms; coil voltage is 28 v. dc with .1 amperage.—**Hart Manufacturing Co., Hartford, Conn.**—TELE-TECH

Electrometer

Model 200 vacuum tube electrometer is a self-contained dc voltmeter which has an extremely high input impedance. It



measures voltages on two ranges, 2 v. to 20 v. full scale, and has an input grid drift current of less than 5 x 10^{-14} and 5 x 10^{-13} amps for the two scales respectively. The input resistance is greater than 10^{14} ohms, and the capacitance is approximately 6 $\mu\mu$f. The circuit is simple and stable. The instrument uses a single vacuum tube, degeneration, and battery potential compensation. With the input terminals connected together, there is less than 0.002 v. per hour drift on the 2-v. range and less than 0.02 v. per hour drift on the 20-v. range.—**Keithley Instruments, 1507 Warrensville Center Road, Cleveland 21, Ohio.**—TELE-TECH

HEART OF A *good* RECORD-CHANGER

It's General Industries' turret-type, 3-speed motor, currently being supplied to record-changer manufacturers.

In this highly efficient design, turntable speeds of 33⅓—45 and 78 RPM are secured through three separate pulleys mounted on a turret plate. By means of a simple lever, the desired pulley is brought into contact with the idler wheel. The two pulleys not in contact with the idler wheel remain stationary.

In addition to this turret-type motor, General Industries also offers the popular Model TR turret-type, manual 3-speed motor, as well as the Model TS belt-drive 3-speed motor for both manual and record-changer applications. Write today for full information on all models.

General Industries also offers a complete range of single and dual-speed phonomotors to meet every phonograph and record-changer requirement. Complete details on request.

The GENERAL INDUSTRIES Co.

DEPARTMENT L • ELYRIA, OHIO

TELE-TECH's NEWSCAST

NARTB Engineering Convention April 15-18

When the broadcast industry's convention opens at the Stevens Hotel in Chicago on April 15 the faces will be the same and the atmosphere will be the same, but the old National Association of Broadcasters will not be the hosts—instead the new National Association of Radio and Television Broadcasters will welcome the members and guests.

At the time of going to press the conference program was not available, but a preview of the highlights of the meeting showed the following:

Monday, April 16. The conference opens with an address by the officers of NAB. There will be no engineering program this day, and in lieu of the usual Industry-FCC Panel an Industry-Government Panel will be held dealing with such things as mobilization, manpower, and technical and material problems. The FCC, it is understood, had to decline to full participation this year due to pressure of workload and budget problems. However, there *will* be limited participation by some of the FCC leading lights.

Tuesday and Wednesday, April 17, 18. On these days will be held the familiar engineering sessions and an extremely well rounded program of papers is promised. The only fly in the ointment as far as the papers committee is concerned was the frequency with which the word "restricted" appeared in letters concerning papers to be presented! There will be guest and member luncheons on each of the two days which are included in the registration.

Thursday, April 19. This is the period set aside for the programming and operating sessions, and there will be no engineering discussed on this day. On Monday evening the Joint Reception will be held in the Stevens Hotel for members and attending engineers; and on Wednesday evening will be the Banquet for members and all others who wish to attend.

On the lower floors of the hotel will be the usual exhibition of larger units of radio and television equipment. The list of exhibitors may be smaller than usual since several are so busy with government orders that they have had to decline invitations to be present. On the fourth and fifth floors will be the smaller equipment exhibits and various demonstrations.

24-IN. GE TV TUBES

Inline annealing oven at General Electric's picture tube plant in Syracuse is built especially for 24-in. metal picture tubes. Each tube is on a trolley which moves slowly through carefully controlled temperature zones in the oven. This process removes sealing stresses and imparts increased strength to tube face

Washington Air Raid Warning System

Frequency modulated transmitters in the 40-50 MC band with a supersonic code signal will operate public address loudspeakers and sirens in the whole District of Columbia in the event of air raids. Thirty-four high powered amplifiers will be activated by receivers similar to those used in transit radio and other specialized FM services. Other frequencies will be used for point-to-point signalling between the Command Center and the Control Centers, and for portable and mobile operation.

Crowley Receives Doctorate

In recognition of his contributions to the ceramic and metallurgical arts, the honorary degree of Doctor of Engineering has been conferred on Henry L. Crowley by his alma mater, Stevens Institute of Technology. Dr. Crowley heads Henry L. Crowley & Company, Inc., of West Orange, N. J., manufacturers of steatite parts and powdered-iron cores widely used in radio, TV and other electronic assemblies.

Central Stamping Moves Into New Plant

The Central Stamping & Mfg. Co. is now operating from its new home in Polo, Illinois. The company was formerly located at 1520 N. Halstead Street, Chicago, Illinois. Conveniently located in the midwest, Central now supplies many of the leading names in industry. Written inquiries as to just how Central can help solve any manufacturer's metal carrying case problem, or perhaps manufacture some piece of equipment adaptable to Central's production facilities are welcome.

Coming Events

April 8-12 — Electrochemical Society, National Meeting Wardman Park Hotel, Washington, D. C.

April 14—IRE Cincinnati Section, Fifth Annual Spring Technical Conference, Engineering Society Headquarters, Cincinnati, Ohio.

April 15-18—National Association of Radio and TV Broadcasters, Convention, Hotel Stevens, Chicago.

April 16-18—Joint Meeting of IRE and URSI, IRE Professional Group on Antennas and Wave Propagation, Spring Meeting, National Bureau of Standards, Connecticut and Van Ness Streets, N.W., Washington, D. C.

April 19-20—Armed Forces Communications Association, Fifth Annual Meeting, Drake Hotel, Chicago.

April 20-21—Southwestern IRE Conference, Dallas-Fort Worth Section and Student Branch, Southern Methodist Univ., Dallas, Texas.

April 30-May 4 — Society of Motion Picture and Television Engineers, 69th Semi-Annual Convention, Hotel Statler, New York City.

May 21-23—Electronic Parts Distributors Conference and Show, Stevens Hotel, Chicago.

May 23-24—American Society for Quality Control, Fifth Annual Convention, Hotel Cleveland, Cleveland, Ohio.

May 23-25—National Conference on Airborne Electronics, Dayton Section of IRE, Dayton Biltmore Hotel, Dayton, Ohio.

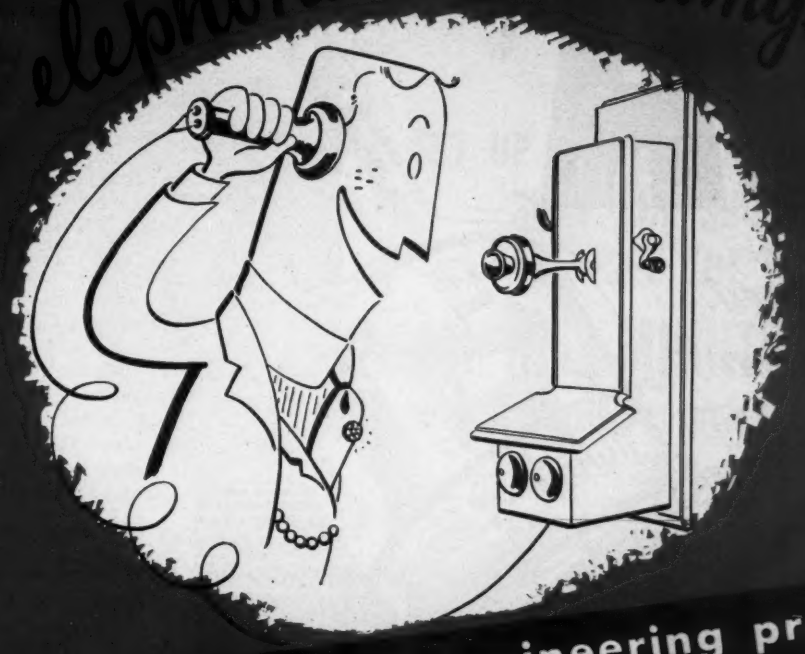
June 18-20 — American Society for Testing Materials, Annual Meeting, Atlantic City, N. J.

June 25-29 — AIEE Summer General Meeting, Royal York Hotel, Toronto, Canada.

August 29-31 — 7th Annual Pacific Electronic Exhibit, IRE and West Coast Electronic Manufacturers' Assn., Civic Auditorium, San Francisco, Calif.

September 10-14—Instrument Society of America, Sixth National Instrument Conference and Exhibit, Sam Houston Coliseum, Houston, Texas.

Telephones have changed....



...and in this era of engineering progress MODERN ELECTRONICS LOOK TO Hi-Q*

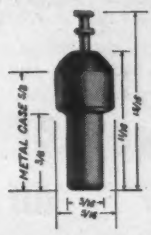
Capacitors • Trimmers • Choke Coils • Wire Wound Resistors

Yes, telephones have changed, and countless developments have played a part in electronic progress since the day of those old stem winders on the wall. Compactness, engineering precision and never-failing dependability are now demanded where the only question once was, will it work at all? In meeting these modern demands of modern electronics for modern ceramic components, **Hi-Q** has led the way.

The **Hi-Q** trademark is unquestioned assurance of capacitors, trimmers, choke coils and wire wound resistors that are uniformly dependable in every respect and rigidly meet specifications and tolerances. As the leading specialists in the ceramic field, **Hi-Q** has come to be regarded by producers of radio, television, communications and other electronic equipment, as their best source of technical assistance in developing new components to meet the special needs of any circuit. **Hi-Q** engineers are at your service any time you see fit to call them.

JOBBERS—ADDRESS: 740 Belleville Ave., New Bedford, Mass.

METAL CLAD STANDOFF



(Illustration Actual Size)

Ceramic tube of this quick mounting capacitor is enclosed in Cadmium plated metal case with special end seal for protection against humidity and temperature changes. Capacity 1500 mmf ± 500 mmf.

BETTER 4 WAYS

- PRECISION
- UNIFORMITY
- DEPENDABILITY
- MINIATURIZATION

Hi-Q*

**Trade Mark Registered, U. S. Patent Office*

Electrical Reactance Corp.
OLEAN, N. Y.

SALES OFFICES: New York, Philadelphia, Detroit, Chicago, Los Angeles

PLANTS: Olean, N. Y., Franklinville, N. Y. Jessup, Pa., Myrtle Beach, S. C.

RCA TUBES

The standard of comparison

Convenient, near-by service ...on tubes for TV*

RCA Tube Distributors are the leading distributors in their territories . . . and are fully equipped to offer you efficient, *local* service on your RCA tube requirements.

For the best tubes that money can buy . . . order RCA quality tubes from the RCA Tube Distributor in your locality.

*RCA's unparalleled research facilities, engineering background, and manufacturing experience contribute to the dependability and operating economy of every RCA television tube. To get all the performance you pay for . . . buy RCA quality tubes.

RCA RADIO CORPORATION of AMERICA

ELECTRON TUBES HARRISON, N.J.

Southwestern IRE Meet

The 1951 Southwestern IRE Conference for 1951 will be held on the campus of Southern Methodist University in Dallas, Texas, April 20-21. The chairman of the meeting will be Associate Professor E. J. O'Brien, of Southern Methodist University. In addition to the numerous papers which will be presented at this meeting there is to be a large engineering exposition where many of the latest developments in radio and television will be presented.

Among the speakers to be heard will be: Dr. Cornelius Lonczos, National Bureau of Standards, Institute of Numerical Analysis, University of Calif., whose subject will be "The Radiation of a Cylindrical Antenna"; N. Marchand and M. Leifer, Sylvania Electric Products, who will talk on "Modern Trends in the Design of Navigation Systems"; and Herbert G. Lindner, of Coles Signal Laboratories, who will speak on "Time Domain Concept of Communication".

Central Transformer Opens in Chicago

The Central Transformer Company, with offices at 910 West Jackson Boulevard, Chicago 7, Ill., has been formed. Principals of the company are Morton R. Whitman, president, and Lloyd G. Shore, secretary-treasurer. Mr. Whitman was formerly chief engineer of Thordarson Electric and has been in the electronics field as a teacher and engineer for the past 10 years. Mr. Shore was formerly in charge of Geiger-counter production at Radiation Counter Laboratories, a pioneer and leader in this field. Mr. Shore has done extensive development work in the field of radiation instruments.

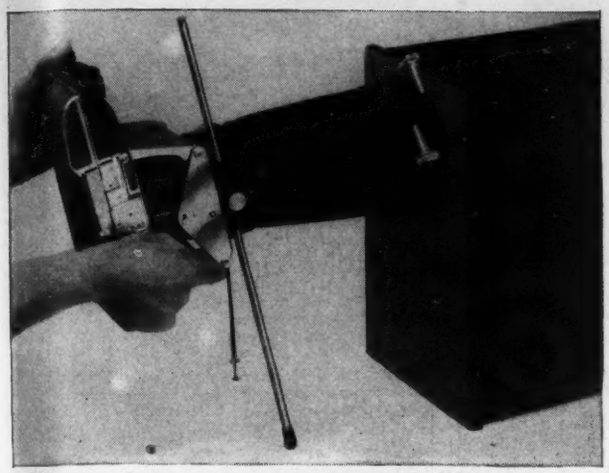
Central Transformer Company will specialize in custom transformer design and manufacture, and will provide a service, not now available in the industry, to equipment designers and builders.

Military To Explain Packaging Needs

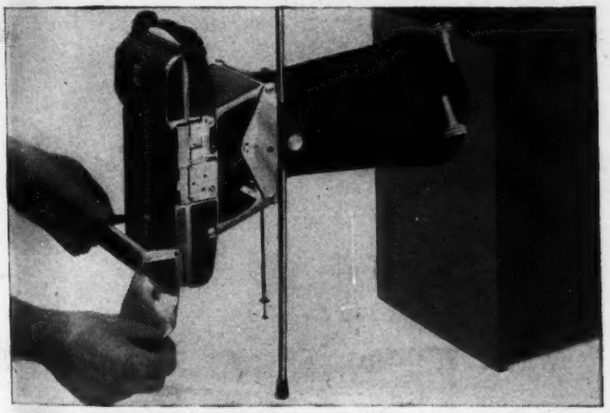
Packaging requirements of the armed forces will be explained to industry by representatives of the Army, the Navy, and the Air Force, at the American Management Association's three-day national Packaging Conference, April 17-19, at the Auditorium in Atlantic City.

Speakers from the armed forces who will take part in the session on "Military Packaging Requirements" will include: Colonel John A. Way, U. S. Air Force, Chief, Munitions Board, Packaging Division; C. K. Royce, Office of Naval Material; William D. Long, Chief of the Packaging Laboratory, Air Material Command, Wright Field, Dayton, Ohio; Captain C. E. Shafer, USAF Procurement Division, Headquarters Air Material Command, Wright Field.

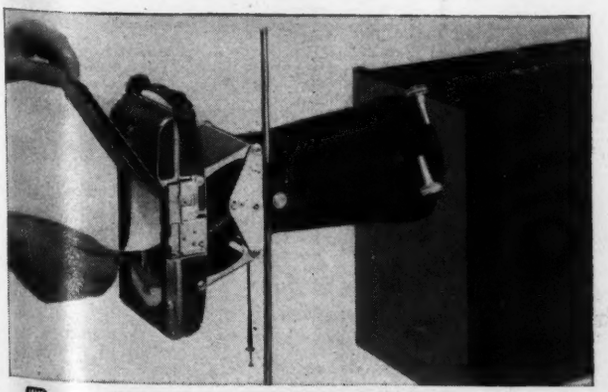
How to make Oscillograms FAST!



Set up the camera. The Fairchild-Polaroid camera consists of three units: adapter ring, hood, and camera body. To set it up, you place the handy adapter ring over the oscilloscope bezel, slip the hood into the ring, then snap the camera into the bayonet lock on the hood. That supporting rod is a safety feature that protects both camera and oscilloscope.



Pull the tab to finish exposed print. After a snap of the shutter, the exposure is made and you're ready to finish the print. If you want two exposures, it's easy to move the camera body down and make a second exposure. To finish the print, you merely pull tab at back of camera.



Remove the finished print. A minute after you've pulled the tab, the finished print is ready for evaluation. Just open the camera back and there it is. An easy job, but you have a photographically accurate record of the trace in less time than you could sketch it from memory.

—SET UP THE CAMERA
—SNAP THE SHUTTER
—SEE THE PRINT

ALL IN 3 MINUTES—or even less
with the Fairchild-Polaroid® Oscilloscope Camera

The easiest way is the fastest way when you're photographing oscilloscope images with the Fairchild-Polaroid® Oscilloscope Camera.

No more darkroom processing! With this new camera it takes only two minutes (less if you're fast) to set up and snap the picture, one minute to finish a print. Each 3¼ x 4¼ print records traces exactly one-half life size to make comparisons easy.

Write for complete data and prices on F-284 Oscilloscope Camera Kit including camera, carrying case, and film. *Fairchild Camera and Instrument Corporation, 88-06 Van Wyck Boulevard, Jamaica 1, N. Y.* Dept. **120-14B.**

SPECIFICATIONS

LENS—Special 75 mm. f/2.8 Wollensak Oscillo-anastigmat.

SHUTTER—Wollensak Alphax; speeds 1/25 sec. to 1/100 sec., "time," and "bulb."

FOCUS—Fixed (approx. 8 in.)

PICTURE SIZE—3¼ x 4¼ in. (2 or more images per print; 16 exposures per roll of film.)

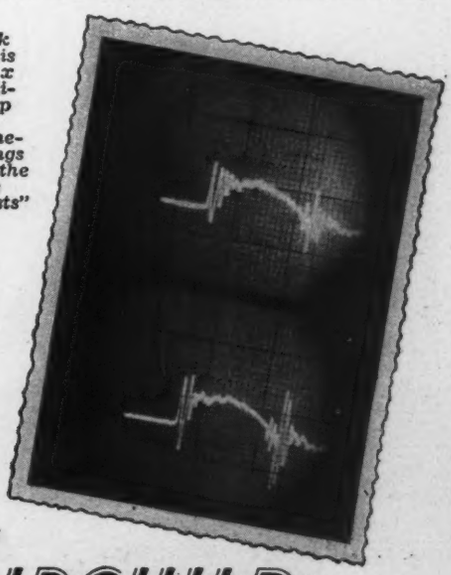
IMAGE SIZE—One-half reduction of scope image.

WRITING SPEED—to 1 in/μsec at only 3000V accelerating potential; higher speeds at higher voltages.

DIMENSIONS—Camera, 10½ x 5¼ x 6¼ in.; hood, 11 in. length, 7½ in. dia.; adapter, 2 in. width, 6⅝ in. max. dia.

WEIGHT—Complete, 7¾ lb.

Typical of the work being done with this camera is this 3¼ x 4¼ print of 35-millisecond single-sweep transient—one of a series of accelerometer-output recordings that made possible the completion of nine recorded "drop-tests" in 40 minutes.



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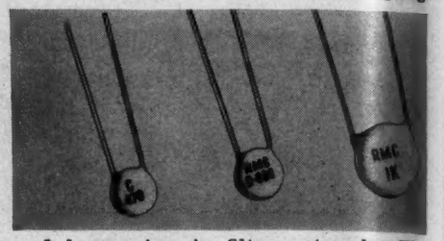
120

IRE New Products

(*Continued from page 47*)

Capacitor

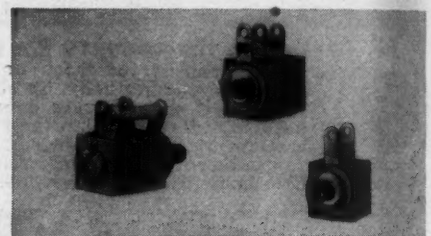
A new series of "Discap" ceramic capacitors developed for use when a more stable capacity is required for coupling



and by-passing in filter networks. The actual capacity change from the capacity at 25°C is only ±3%. The capacity loss at 55°C is —39%. Type D Discaps are available in capacities between 150 mmf to 2000 mmf and tolerances of ±10% and 20%.—**Radio Materials Corp., 1708 Belmont Ave., Chicago 13, Ill.**—TELE-TECH

Selenium Rectifiers

Three new selenium rectifiers have been developed. They are known as types 16Y2, 8Y1, and 16Y1, and have



cells which are one-half inch square.—**Radio Receptor Co., Inc., Seletron Rectifier Div., 251 West 19th St., New York, N. Y.**—TELE-TECH

Capacitor

A new line of capacitors include miniature and sub-miniature types has been developed, featuring special coatings and constructions. Miniature stand-offs, high frequency units, and the molded plate capacitor are among the company's latest developments.—**Mucon Corp., 9 St. Francis St., Newark 5, N. J.**—TELE-TECH

Grid Dip Meter

In addition to having an individually hand calibrated direct reading dial the new model 90662 grid dip meter has an

extended frequency range to cover the entire spectrum from 220 KC to 300 MC. Included with the new grid dip meter is also a remote probe for coupling into extremely small and normally inaccessible places.—**James Millen Mfg. Co., Malden, Mass.**—TELE-TECH

Capacitors

Type PG "Glasseal" miniature paper capacitors are assembled in metal tubes with glass-metal terminals. They will fully meet the most exacting demands of high vacuum, high pressure, temperature cycling, immersion cycling and corrosion tests. Rated ranges are: Temperature, —55° to +125°C; Capacitance .001 mfd. to 1.0 mfd.; Voltage, 100 to 600 volts dc operating.—**Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J.**—TELE-TECH

Production of GLOBAR brand ceramic resistors is being directed to manufacturers of defense equipment in ever-increasing quantities. These manufacturers must, necessarily, receive first priority if they are to produce critically needed equipment during this national emergency.

However, our productive capacity is such that we are able to meet most needs of producers of civilian equipment—and will continue to do so in every way that does not affect defense production.

The unique characteristics of GLOBAR resistors have resulted in many improvements in circuit designs. Whether you are producing defense or civilian equipment, it will pay you to investigate the many types available. Our complete co-operation is assured. Write Dept. T-41, The Carborundum Company, GLOBAR Division, Niagara Falls, New York.

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How to eliminate set screws and rivets with Rollpin self-locking fasteners

Now put real fastener economy into your assembly procedure. With Rollpin metal fasteners as replacements you can eliminate many rivet and set screw applications and avoid the peening or threading operations which they require. One stroke of a press sets a Rollpin firmly in place, flush with the face of your assembly. This means real savings to you in costs and time.

It will pay you to investigate Rollpins for your product as a cost saving replacement for steel fastening pins, pivot or hinge pins, clevis pins, cotter keys, locating dowels, or shafts.

Rollpins exceed the shear strength of cold-rolled pins — are easily adapted to jig assembly or automatic hopper-fed presses. They provide a firm vibration-proof fit until deliberately removed with a pin punch . . . and since Rollpins do not enlarge the hole, *the same pin* can be re-inserted with a hammer!

For details on Rollpins, write to Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, New Jersey.

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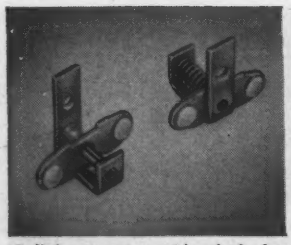
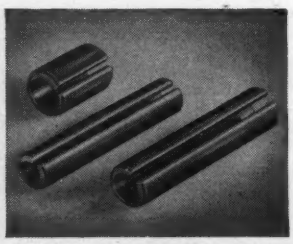


Rollpin acts as guide shaft for spring-loaded relay contacts. Simply inserted . . . riveting operation eliminated . . . it outwears previous brass rivet by ten times.

Rollpins replace set screws for pinning pulleys to shafts. Hole tapping operation is avoided and Rollpin holds tight against vibration until deliberately removed.



Rollpins are supplied to specified lengths with chamfered ends. Available from stock in diameters from 5/64" to ½" in Carbon and Stainless Steels.

Civil Defense

(*Continued from page* 38)

lay but is much higher than any noise pulses which might override the filter circuits.

An illustration of a frequency selective relay appears in Fig. 4. A "Q" of 250 is not unduly hard to obtain. For mechanical reasons the reed should be designed to have its tolerance fall on the lower side of the critical frequency. Similar reasoning dictates that about 5/32 of an inch should be the spacing between the reed and its contact to prevent noise actuation, and hence false signalling.

The question of a suitable selection of code groups and frequencies for operation of such a selective calling device is involved and should be decided immediately by the Office of Civilian Defense; up to the time of writing the decision had not been made, although comprehensive recommendations have already been made to the office.

Assuming that the frequency band 20 to 40 cps is used, with a channel width of 2 cps, there will be available ten channels for signalling. Thus, for example, 30 cps might be YELLOW, 32 cps RED, and 34 cps WHITE warnings. A call on any one of these frequencies would alert the defense parties at the desired level, and the public need not be frightened by recurring YELLOW warnings which never become RED. This is a simple application, of course, and in actual operational use different frequencies would serve different public defense units. Because of the limit of ten channels it might be necessary to go further in the coding by diplexing the frequency selective relays, and arranging for, say, hospitals to respond to 36 cps, and emergency ambulance services to 36 cps followed by 30 cps, etc. Obviously any number of combinations can be produced according to the need. But until some definite action is taken by the proper authorities manufacturers cannot proceed any further with the design and production of such equipment.

An ingenious internal siren effect is provided in the receiver unit of Fig. 3 by the use of feedback from the loudspeaker voice coil to the first audio stage. When the "on" relay closes oscillation occurs in this circuit, and is varied in frequency by the neon glow lamp. This produces a "warbling" tone whose frequency and rate of change is dependent on the circuit constants and component arrangement.

This siren is an optional feature for it will be obvious that it is equally feasible to provide an extra

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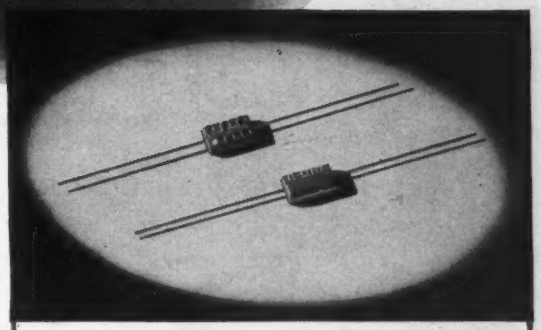
Tiny as it is, the El-Menco CM-15 high-capacity fixed mica condenser exceeds the strict requirements of the Army and Navy. It is tested for dielectric strength at double its working voltage *before* leaving the factory — for insulation resistance and capacity value. You can *always* depend on this mighty midget — even under the most critical operating conditions and climate extremes.



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Actual Size 9/32" x 1/2" x 3/16"

For Television, Radio and other Electronic Applications.

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2 mmf. to 525 mmf. cap. at 300v DCw.

Temp. Co-efficient ± 50 parts per million per degree C for most capacity values.

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T-51/ARQ-8	RT-24/APX-2	R-69/ARN-9
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contact on the relay which will close a bell, or other warning device circuit when an alarm is received. However, by making use of the feedback feature of the receiver itself economy in components is effected and a distinctive warning signal is obtained.

If the receiver is operating, either muted, or with a broadcast program audible, reception of a suitable sub-audible tone will close the relay and sound the siren. The "Alert-Receive" switch is then thrown to the "receive" position and the message received. After transmission of the message, the "off" signal is transmitted; this causes the siren to sound. To silence it the operator must place the switch in the "alert" position ready for the next call.

In general, sub-audible tones have been chosen rather than the much stressed sub-carrier system popular today in some FM systems because most telephone lines will transmit such frequencies without special attention, whereas the 20 kc signals of the sub-carrier and "controlled" signal systems require special high frequency equalization to pass such frequencies without excessive attenuation.

Although no decisions on policy have yet been made by the military, it will be quite apparent that it would not be in the public interest to silence broadcast stations in time of emergency. Therefore control and communication equipment of this type is certain to be required. The public has been conditioned for so long to rely on radio for its current information that any cessation of such a service in time of enemy operations would have an extremely demoralizing effect on the population. This is particularly so in the United States and Canada for in no other countries are to be found as many stations serving purely local areas. Even assuming that it was considered necessary to silence a local station, the last signal transmitted by it could be the code to activate the defense receivers.

Acknowledgment is made to Mr. Arthur F. Van Dyck of RCA Laboratories for his assistance in preparing this article.

1. Small Town Mobile FM Operation, Eugene Cook. TELE-TECH, Feb. 1950.

Output Balancing of Synchronizing Generators

In the "Cues for Broadcasters" section of the March issue, "Output Balancing of Synchronizing Generators" appeared. The author, C. J. Auditore, says that J. S. Schaller of NBC Engineering Maintenance should be credited with originating the idea.

Want to make your product safer to use?

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WHEN you can show a customer that your product is safer to use than your competitor's, you've got a big start toward clinching the sale.

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Plan now to design greater safety and utility into your product with General Electric miniature lamps. They're available in both filament and neon glow, in many types and sizes. You're always sure of long, dependable service from G-E lamps because General Electric Lamp research is always at work to make G-E lamps *Stay Brighter Longer.* Lamp Department, General Electric Co., Nela Park, Cleveland 12, Ohio.

GE LAMPS

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GENERAL ELECTRIC

Critical Raw Materials

(*Continued from page 33*)

netic speaker designs in which case an increase in copper consumption of about 1 lb. per field coil would be required. Electrostatically focused cathode ray tubes will of course eliminate focus magnet requirements, although manufacturing costs per instrument will rise somewhat with such tubes.

To conserve copper, power transformer shorting bands originally specified to be 40 mils thick and 2 in. wide will now only be 20 mils thick. Hook-up wire has been reduced in gauge from 22 to 24. Copper clad steel wire instead of copper wire will be used on wire-wound resistors and chokes, and may also be employed as 300-ohm transmission line in TV installations. Gauge of 300-ohm transmission line has been reduced so that 7 strands of No. 30 instead of No. 28 will yield a 234 ft. length per lb. of copper as contrasted to the standard 147.5 ft. In coaxial transmission line systems, tests are being conducted to replace the copper braid shield with thin aluminum foil sheath. This cable now uses 22.5 lbs. of copper per 1000 ft. and 20 lbs. are in the sheath. The new coaxial will contain only 2.5 lbs. of copper and ¾ lbs. of aluminum per 1000 ft.

To conserve nickel, a new material known as S8S1 is being produced for application as a new plate (anode) material. This raw material, carbonized nickel-plated steel strip, is a substitute for pure nickel. Nickel-plated iron wire, Nipron, is being used in the manufacture of receiving tubes as a substitute material for copper grid side rods.

The conservation program is also being followed through to the installation of a TV receiver in the purchaser's home. Savings here are effected primarily by using smaller amounts of material through careful location of the receiver with respect to the outside antenna, using smaller antenna mounting masts, lighter gauge masts, lighter gauge aluminum antenna elements, and by the substitution of steel for aluminum wherever possible.

Philco calls their newly-designed chassis a "performance-conservation" receiver. In Washington, early in February, key officials in Military and Defense Production were shown the results of a two-year engineering program to reduce to a minimum the amounts of critical materials used in the television sets.

The substantial savings of critical materials in the new TV set are as

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- In big-picture tubes, more than ever, fine-line focus—clear across the screen—is an important function of the electron gun.
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follows: aluminum 68%, alnico No. 5 100%, silicon steel (power and low frequency transformer cores) 58%, copper 26% net, ferrite (high frequency transformer cores) 51%, nickel 15%, as well as savings in brass and cadmium for plating. Various government production administrators, after seeing the results of Philco's conservation developments were well pleased, not only with the savings in materials but with the willingness to make these developments available to the entire industry.

To demonstrate that the performance of the conservation model equalled that of the present standard TV receiver, a side-by-side comparison of picture quality was made. Many attending the showing for the press guessed wrong when asked which set was the conservation model. The test of the effect of low line-voltage (90 V.) revealed that the new model, with electrostatic focusing, remained in focus better than the current model. It is claimed that in areas of difficult reception the new model is superior.

The new set will cost approximately the same as the present set because, while there are savings on some materials, the electrostatic (ES) tube costs more to build than the magnetically-focused tube. The assembly time is about the same on the two models. The new chassis will be offered with 17" and 20" picture tubes.

Material savings are effected by:

1. *Electrostatic Focused Picture Tube.* This eliminates the Alnico (cobalt) permanent magnet or the copper coil for electromagnetic focusing.

2. *New Deflecting Circuits.* These use lower plate voltage, a smaller horizontal transformer. These are made possible by Philco's development of a new tube, 6V3, a diode damper. Elimination of copper and ferrite in width and linearity coils results from the use of a circuit in which width control is accomplished by resistance variation.

3. *New Power Supply.* The heavy power transformer is replaced by selenium rectifiers in a voltage-doubling circuit (plus a small filament heater transformer), thus saving silicon steel and copper. The weight of the entire set has been reduced more than 12 pounds.

What effect on performance would these changes be likely to produce? The change to ES focusing in the picture tube should involve no change in picture quality, but the more complicated gun would cause the tube to be slightly more expensive. Good deflecting circuit performance is assured by the use of the new Philco tube, 6V3. The replacement of the power transformer by voltage-doubling rectifiers, a scheme in use for some time by other manufacturers, means that the plate voltage supplied to the chassis has been reduced from 320 to 250 volts, which causes no difficulty.

Fig. 1 shows the savings of materials in various parts of the chassis.

Similar savings are accomplished in Philco's new model of phonograph, for instance: aluminum 100%, brass 100%, phosphor bronze 100%, stainless steel 50% and zinc 83.5%.

Had the entire TV industry followed a conservation plan, such as that outlined, the savings for the year 1950 would have been: aluminum 2100 tons, cobalt 440 tons, copper 4600 tons, ferrite 2950 tons, nickel 224 tons and silicon steel 27,600 tons. These figures allow the conservation program to be viewed in its true perspective.

WCAU Radio-TV Center

Foundations have been completed for the new, 100,000 square foot radio and television center which WCAU is erecting on a 10-acre site outside Philadelphia's business district.

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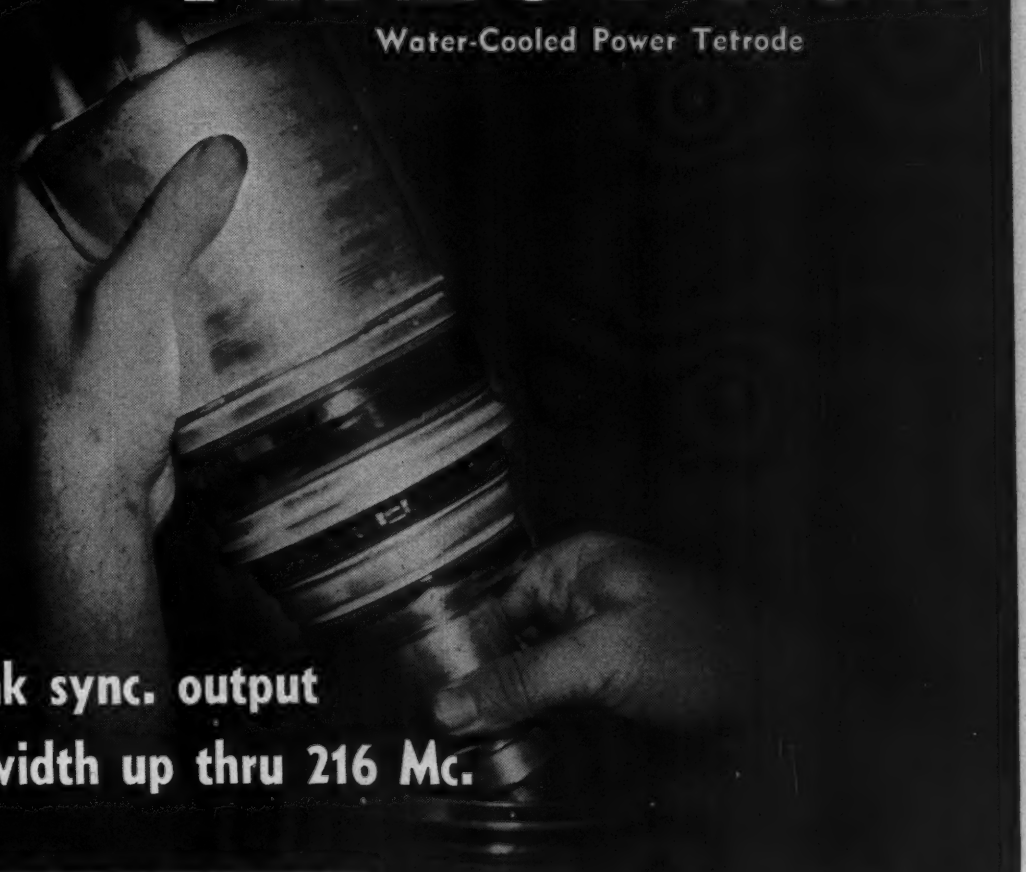

20 kw. peak sync. output
5-Mc bandwidth up thru 216 Mc.

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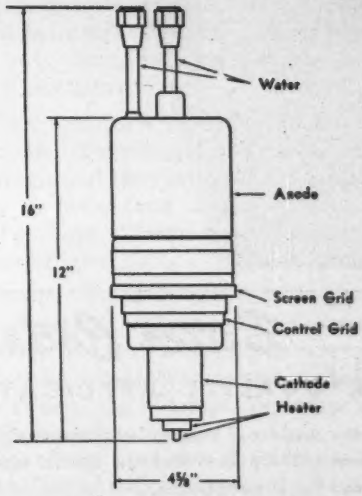
Load Impedance	400 Ohms
Effective Length of Plate Line	Quarter Wave
D-C Plate Voltage	5500 Volts
D-C Plate Current	7.1 Amps
D-C Screen Voltage	1000 Volts
D-C Screen Current	600 Ma.
DC- Grid Voltage	—310 Volts
Peak R-F Grid Input Voltage (approx.)	485 Volts
Plate Power Input	39.1 Kw.
Plate Dissipation	19.0 Kw.
Plate Power Output	20.1 Kw.



For the practical approach to high-power TV through channel 13, here is the tube . . . the new Eimac 4W20000A power tetrode.

Among the features of the 4W20000A are a unipotential cathode of thoriated tungsten heated by electron bombardment, a water-cooled anode rated at 20 kw dissipation, and coaxially arranged terminals.

This new tube's potential applications are not limited to TV service. Data on typical operation in class-C telegraphy or FM telephony as well as class-B linear TV amplifier service are included in a comprehensive data sheet . . . available for the asking.

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LOS ANGELES 46

TV Test Equipment

(*Continued from page* 32)

omit a spot frequency check of the i-f coils because these preliminary adjustments may be made when using the i-f sweep signal generator. Other manufacturers, unwilling to have their production depend too much upon the availability of highly trained personnel, prefer the two position i-f test as outlined in Fig. 3.

Since most test signals can be produced interchangeably from individual or centralized signal generating equipment, the advantages of individual signal generators lie mainly in low initial cost, simple installation problems, and their adaptability to many types of production layouts. In addition, many voices in the industry stress the reliability of these generators, particularly in r-f tests.

In some plants where central signal generating systems are used, individual signal sources are nevertheless maintained and used in the line from time to time so that in the event of failure of the central sources, partial production at least may be maintained.

Grouping together those manufacturers who use little or no central signal generating equipment, costs for production test equipment average $15,000 per 100 sets daily. Those plants depending mainly upon central sources for the majority of their test signals use $20,000 worth of test equipment, per 100 receivers. The semi-centralized plants come in between these two figures, averaging $16,500 in test equipment costs for 100 sets.

The total cost of test equipment among those TV manufacturers studied was $1,116,000 for production facilities—plus $217,000 for laboratory and quality control equipment—or a total of $1,333,000 for a production of 6700 TV receivers daily. Projecting these figures on the present production of 7-million sets for 1950, we find that the total investment of the industry for test equipment in TV receiver manufacture is approximately $6,500,000!

Every plant devotes some test equipment to Quality Control, Incoming Material checks, and in many cases also maintains Laboratory facilities devoted to improving TV production. (Research and circuit design equipment has not been included in these statistics.)

Test equipment for these purposes, such as Q-meters, Bridges, Wide-Range Oscilloscopes, Laboratory Power Supplies, Decade Boxes, etc. are usually high-cost, precision instruments. A group of such equip-

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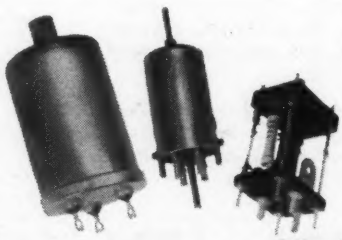

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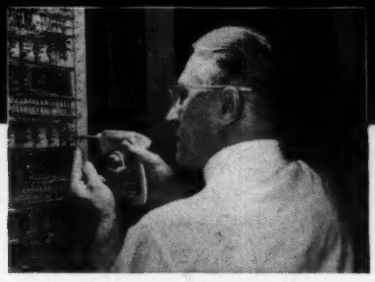
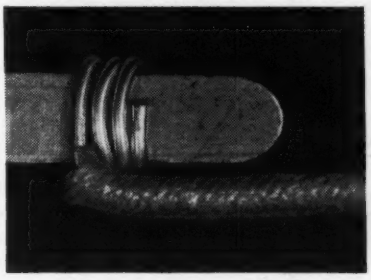
METUCHEN 6-2245

This "gun" shoots wire around corners



Bell Telephone Company craftsman wraps a wire to complete a connection. Wire is inserted into the nozzle and a rotating spindle whips it around terminals.



Close-up of connection made with new tool—neat, tight windings.

IT DOESN'T take long to wrap a wire around a terminal and snip off the end. But *hundreds of millions* of such connections are being made each year to keep up with America's growing demand for telephone service.

Now this job is done much more efficiently with a new wire wrapping tool invented at Bell Telephone Laboratories. This "gun" whirls wire tightly around terminals before solder is applied. The connection is better and there is no excess wire to be clipped off — perhaps to drop among a maze of connections and cause trouble later.

The new tool is being developed in different forms for specialized uses. The hand-operated wrapper in the illustration is for the telephone man's tool kit. Power-driven wrappers developed by Western Electric, manufacturing unit of the Bell System, are speeding the production of telephone equipment. The gun's small nozzle reaches where fingers couldn't — a big advantage these days when efforts are being made to produce telephone system parts smaller as well as better.

Bell Telephone Laboratories scientists devise many special tools that help your telephone system to keep pace with service demands economically — keeping your telephone service one of today's best bargains.

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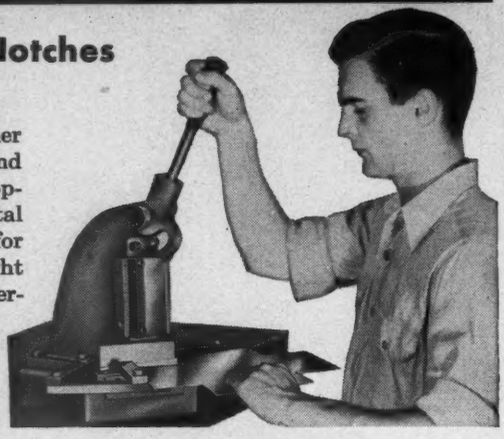
Duplicates Precision Notches WITHOUT DIES!

The new precision DI-ACRO Notcher eliminates the need for punch press and dies on many production notching operations. It is also ideal for experimental work as it can be quickly adjusted for any size or shape notch. Many straight shearing operations can also be performed with this flexible unit.



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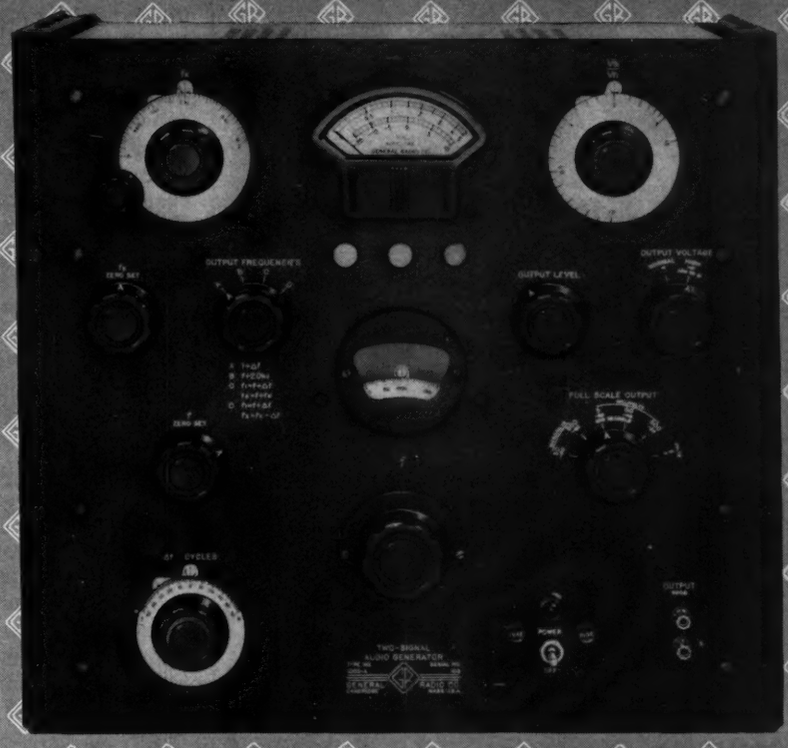
ments therefore can amount to a substantial portion of the total test equipment used in a plant.

Among the manufacturers studied, there is a range of 3.6% to 36.2% of total test equipment (dollar value) devoted to Quality Control, Incoming Materials checks and Laboratory purposes. The average for all plants is 16% of total test equipment being used for Laboratory and Quality Control. However, the smaller plants (under 500 sets daily output) devote an average of 27.8% of their entire testing facilities to laboratory equipment, while the larger plants (above 500 sets daily output) devote only 15.5% on an average to such equipment. This disparity may be due to the fact that very large plants often possess entirely separate Laboratory Divisions (which are not included in this survey), or may in some cases prefer to ignore development work entirely, devoting all their facilities to production.

One of the major differences of opinion among TV receiver plant owners and engineers today is the question of whether to use central or locally situated test signal equipment. The question seems more a matter of engineering philosophy than measured fact, because there exist vigorous, authoritative proponents of both opinions, who are more eager to cite chapter and verse to substantiate their position. In practice, fully half the TV manufacturers, running from the smallest to the largest, have little or no central signal equipment. This percentage will diminish in the future as many of these plants plan to acquire Monoscope Cameras and associated equipment (now that test patterns occupy an increasingly smaller percentage of TV broadcast time). Plants having fully centralized systems are in the minority representing only one fourth the manufacturers, although they account for 30% of set output.

Opponents of the centralized system claim lower equipment costs for their test methods, and this claim seems to be substantiated by fact since the average test equipment costs for locally generated signals ran on the average of 75% the cost for centrally equipped plants. It should be noted, however, that there are numerous other factors influencing the cost of setting up a plant, and that there are many plants where the costs of equipment for a locally generated test signal set-up are higher than for their like-sized competitor using a central signal generating system.

Excellent receivers are being produced with all types of testing pro-



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The new G-R Type 1303-A Two-Signal Audio Generator supplies signals by the beat-frequency method. Three oscillators and three mixers are used to provide a number of output-signal combinations. The output of the mixers are combined in a linear adding network and then amplified through a very low-distortion power amplifier. The output from the amplifier is fed into a 600-ohm attenuator system, with a voltmeter to monitor the level at the input of the attenuator. The harmonic content and inter-modulation products in the final output are at a very low level. High stability of voltage and frequency are provided. The frequency drift from cold start is only a few cycles.

This A-F Signal Generator will supply the following signals:

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- Two low-distortion sinusoidal voltages with fixed difference in frequency maintained between them as the frequency of one is varied. The fixed difference frequency is adjustable up to 10 kc, and the lower of the two frequencies is adjustable up to 20 kc.

The output is continuously adjustable and is calibrated both in volts and in db with respect to 1 mw into 600 ohms. The frequency calibration can be standardized within one cycle at any time. Its accuracy is ± (1% + 0.5 cycle).

This generator is an excellent and versatile signal source for the three standard non-linear distortion tests:

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2. The intermodulation method that evaluates distortion in terms of the resultant modulation of a high-frequency tone by a low-frequency tone.
3. The difference-frequency intermodulation test, which evaluates distortion in terms of the amplitude of the difference-frequency components produced by intermodulation of two sinusoidal test signals of equal amplitude.

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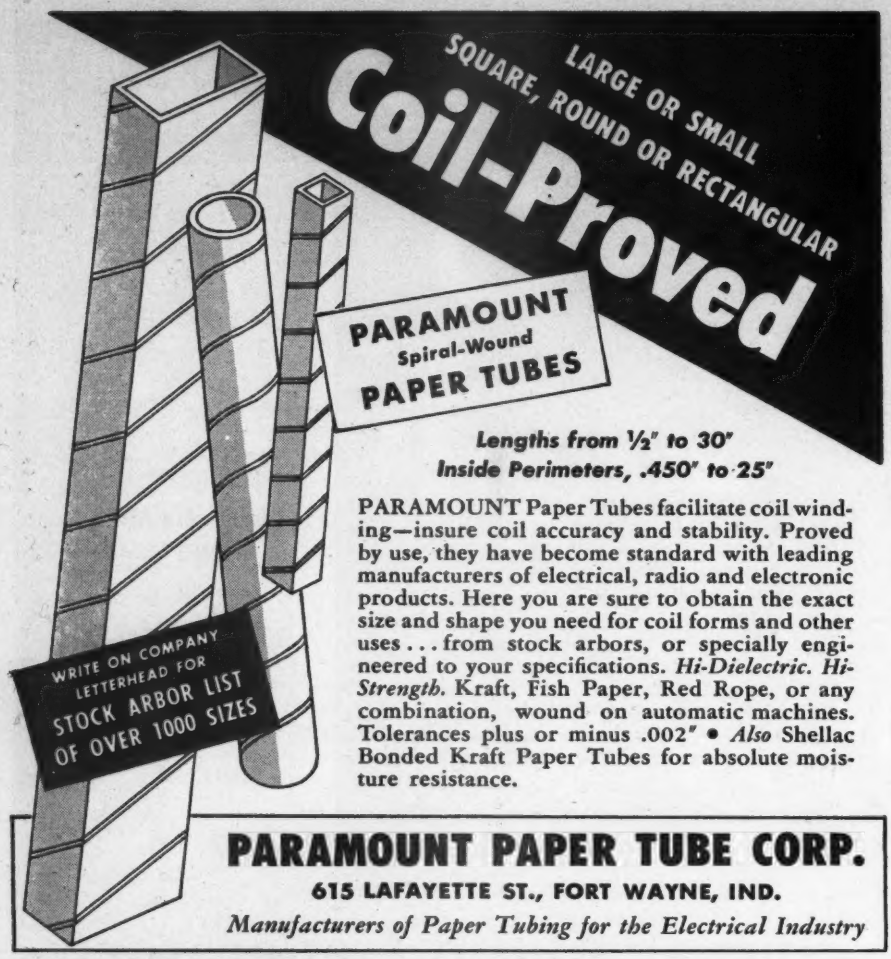

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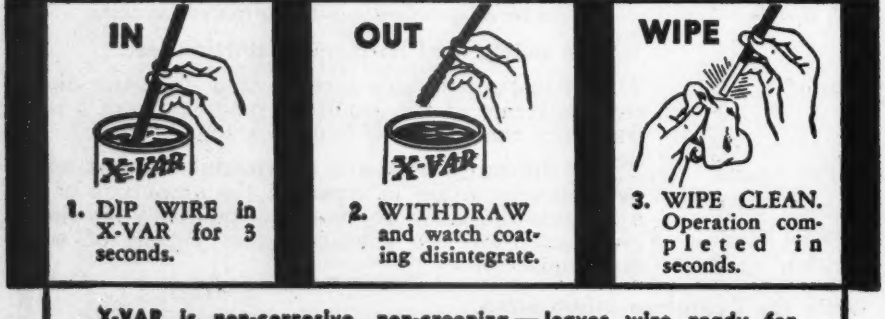

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cedures and equipment, as each plant's engineering department discovers through experience those test methods which best suit their own production requirements. And as defense shortages have their effect upon receiver design, new testing procedures and test equipment will undoubtedly be forthcoming. Such a record represents a tremendous investment in time and inventive ability, as well as the buildings and tools needed to produce such a huge output—a capital investment of which the test equipment alone is conservatively estimated at 16.5 million dollars.

See first article of this series in TELE-TECH, Sept., 1950, page 34.

TV Receiver Operation

(*Continued from page* 49)

undesirable coupling from the former to the latter. Since the bypass capacitors must have short lead lengths, the physical location of the bypass points is limited to the periphery of the sub-assembly. Some degree of success has been obtained, however, because although circulating tank currents flow through the B minus bus (sub-chassis), the bus itself presents an exceedingly low impedance to i-f currents, preventing any appreciable potential difference from being developed across it.

The use of a thin layer of bakelite or other insulating material between the main chassis and a B minus metal sheet has been suggested for television i-f amplifier strips. The insulating layer need be no thicker than that required to meet the Underwriters' Laboratory requirement of a minimum 900 volts voltage breakdown between chassis and B minus. The advantage of this approach is that not only is the B minus plane made relatively large in physical dimensions, but that capacitor point bypassing to chassis may be avoided because of the effectively distributed capacitance throughout the B minus plane to chassis.

Another approach frequently used is to bypass all i-f currents directly to chassis and to insert small chokes or resistors between possible i-f current paths and the B minus line. The latter functions only as a dc return path for the various tubes and is free of i-f current flow. The i-f current paths are all through the chassis, and the i-f strip approaches performance no different from that with power transformer operation.

Fig. 3 demonstrates some of the principles of this method. Both resistance and choke decoupling are

shown for demonstration purposes. Care should be taken to prevent any magnetic field radiation of the choke coils from upsetting normal i-f amplifier action. The value of R is of the order of 22 to 68 ohms, and bypass capacitors of about 1500 to 5000 mmf with short lead lengths are used. Larger values of R may permit the development of potential differences across tube input circuits due to chassis couplings.

Another solution to the problem has been incorporated into the Air-King Model 900-1 television receiver. A metal plate, approximately 7½ x 1 in. is used as the B minus bus in an attempt to approach a zero impedance B minus plane. All B minus returns for each indivdual tube are connected to the same physical point (conveniently, at the tube socket center pin), and each of these points are bypassed to chassis through 5000-mmf button type capacitors. The B minus bus is also connected to each tube's socket center pin via spade lugs, and since this bus is relatively cold to i-f currents, it is so positioned so as to afford some degree of shielding between i-f coils.

The attempt is made to confine the i-f currents of each individual tube in the strip to a vary small area within the neighborhood of that tube. Although there is stil present the unavoidable distributed capacitances to chassis and, essentially, several point capacitor bypassing to chassis is employed (Fig. 1), the large physical size of the B minus bus prevents appreciable potential differences from being developed across it.

The B minus bus also provides an extremely convenient tie-point for the B minus returns from many of the other tubes in the receiver. As an additional precaution, these tie-points have been located near the first i-f amplifier section of the bus; that is, the maximum distance from the last i-f amplifier and video detector sections in which vicinity the i-f currents achieve their largest values.

It is essential that the heaters of tubes carrying r-f and i-f currents be well isolated and bypassed. B minus leads carrying common return currents should be viewed with a healthy suspicion. As an example, in the early bread-board design of the Air-King receiver, some 60 cps hum was observed at the kinescope input. This was traced to the input circuit of the first video amplifier tube, shown in Fig. 2. The 60 cps voltage drop across the wire (a)-(b) including the solder connections, due to the heater current flow, was sufficient, after video amplification, to be annoying at the kinescope input. The cure, of course, was to return the heaters through a separate lead to the B minus bus.

Fig. 4 shows the schematic diagram of an i-f amplifier section using this approach. Note that screen neutralization is employed to avoid regeneration in the second staggered pair. This type of neutralization is not unique to receivers with "floating" B minus busses, but is a function of this particular 6BC5 amplifier stage.

In conclusion, it should be pointed out that various combinations of the better features of the four approaches mentioned might be applied towards successful designs of television receivers with "floating" B minus busses.

REFERENCES

1. H. W. Bode; Network Analysis and Feedback Amplifier Design; Van Nostrand; N.Y.; 1945.
2. E. E. Zepler; Technique of Radio Design; Chapters 8 and 9; Wiley; N. Y.; 1943.

Pacent Gets Marconi Medal

At the 26th Anniversary Dinner of the Veteran Wireless Operators Assoc. in New York City, in February, the Marconi Memorial Medal of Achievement was presented to Louis Gerard Pacent for his pioneer work in radio and communication.

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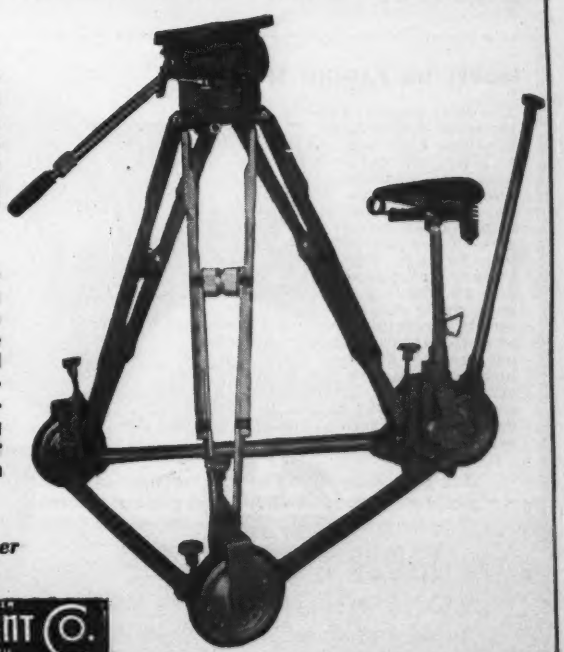
This tripod was engineered and designed expressly to meet all video camera requirements. Previous concepts of gyro and friction type design have been discarded to achieve absolute balance, effortless operation, super-smooth tilt and pan action, dependability, ruggedness & efficiency.

Below: 3-wheel portable dolly with balanced TV Tripod mounted.



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Propagation Measurements

(*Continued from page* 54)

intensity and converter input voltage values corresponding to various classifications of picture quality were determined.

Relative Picture Quality	Field Intensity (DB Above 1 uv/m)	Converter input voltage (across 75 ohms)
Unusable	Below 58 db	Below 125 microvolts
Poor	58-68 db	125-375 "
Fair	68-78 db	375-1200 "
Good	78-96 db	1200-9000 "
Excellent	Over 96 db	Over 9000 "

A local field intensity of 67.7 db was required to produce an r-f signal /noise ratio of 30 db. This figure approximately separates the Poor and Fair range. Therefore, the pictures classified as Fair or better are apparently those for which a signal/noise ratio of 30 db or more was obtained.

Some interesting observations may be made by comparing results obtained at points above and below the optical line of sight. Of the 130 measuring points, 69 (53%) were above optical line of sight, while 61 (47%) were below. This data was obtained from the profile curves for a receiving height of 20 ft., and does not indicate obstructions to optical line of sight due to trees, buildings, etc. The average measured field intensity exceeded the predicted F' (50,50) field at 38 (55%) of the locations above optical line of sight, and was below the predicted field at 31 (45%) of these locations. On the other hand, the average measured field intensity exceeded the predicted F'(50,50) field at only 12 (19.7%) of the locations below optical line of sight, and was below the predicted field at 49 (80.3%) of these locations. Of the 54 locations where the average measured field intensity exceeded the predicted F'(50,50) field, 40 (74%) were above optical line of sight, and 14 (26%) were below.

In order to determine whether the distribution of the measured locations with respect to optical line of sight conditions were typical of the average terrain, a count was made of the total number of points, separated by intervals of 0.1 mile, along all radials, which were above or below optical line of sight. Of the 1800 points thus counted, 889 (49.4%) were above, and 911 (50.6%) were below. These figures agree with those applying to the distribution of measured locations.

The authors wish to express appreciation for the cooperation of Mr. John F. Bell of the Zenith Radio Corp. in supplying assistance and equipment for the calibration of the field test equipment.

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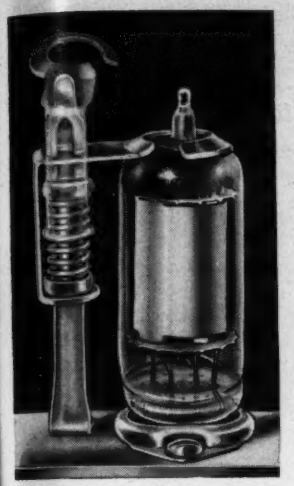

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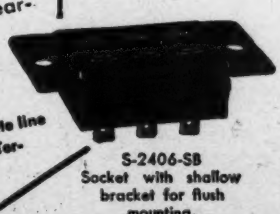

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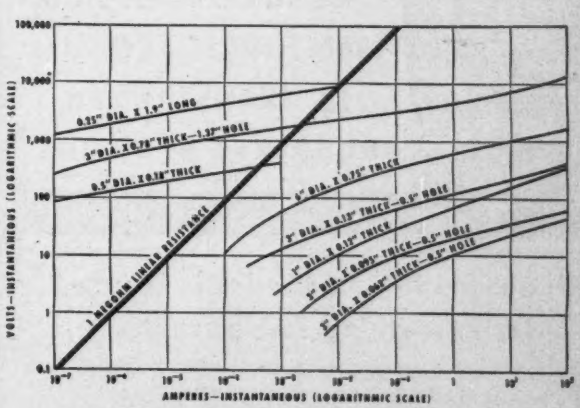
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PERSONNEL

H. I. DANZIGER has been appointed vice-president of the Henry L. Crowley & Co., Inc., West Orange, N. J. This is in addition to his previous duties as general manager. He joined the Crowley organization in 1938 as sales engineer.

WILL BALTIN, who served as secretary-treasurer of the Television Broadcasters Association, Inc., from its inception in 1944, has joined Screen Gems, 729 Seventh Ave., New York, television subsidiary of Columbia Pictures Corp. in an executive capacity.

STANLEY P. LOVELL of Newtonville, Mass., chemist, inventor and 1948 recipient of the Presidential Medal for Merit, has been elected a director of Raytheon Manufacturing Co., Waltham, Mass.

JOHN PARKINSON, formerly with CAA in Alaska and Bendix Radio, North Hollywood, is now sales engineer with Carl A. Stone and Associates, Los Angeles.

ARTHUR L. REESE, formally manager of Motorola's communications and electronics division (west coast region), has been appointed marketing manager of microwave and the carrier and control sections of the company.

A. ROBERT LIEBERMAN has recently left the Jewel Radio Co., Long Island City, N. Y., where for the last four years he has been general manager. Prior to his association with Jewel, Mr. Lieberman was with Air King Radio, Brooklyn, for 12 years in various production and sales capacities, and he is now forming his own organization to manufacture radio and TV components and end products.

Empire State TV Center For Theatre TV

In addition to supporting the transmitting antennas of WPIX, WJZ-TV, WABD, WNBT, and WCBS-TV, the Empire State Building will also provide a jumping-off point for the TV signals of the movie theatre television service if the plans materialize, and when the FCC finally decides to do something about the long pending applications for frequency allocations for this purpose. The theatre relays will probably operate in the vicinity of the 7,000 MC band and employ equipment similar to that presently used for television relays.

There is also a strong possibility that WATV, the Newark TV station will join the other five on the Empire State Building. Since there is no room on the new tower for another antenna it will be necessary for WATV and WPIX to triplex, (or should one say "quadriplex"?) via the WPIX antenna. This will call for a large amount of engineering ingenuity on the part of the engineers to work two video and two aural carriers into one antenna.

Defense Contracts

(*Continued from page* 34)

tion is also maintained by the Philadelphia Signal Corps Procurement Agency under the responsibility of Lt. Col. E. L. P. Mueller. His job is to provide certain guidance to small manufacturers and channel them to the right places.

Manufacturers should be prepared to furnish specific data about their facilities and what they can make. No one will ever get to first base if he insists that he "can make anything." The Signal Corps is interested in manufacturers who can make specific items according to Federal specifications and standards.

The Signal Corps publishes a list of purchased items. It is available for the asking from its main procurement office in Philadelphia (see chart). The Federal specification containing specific manufacturing standards for each item or component is also available from the same agency. By obtaining these specifications, it is possible to determine what you can or cannot make.

Specifically, then, the answers to leading questions are:

Who gets negotiated contracts?

"Manufacturers who have long established research and development facilities specializing in engineering in specific fields."

"Manufacturers with past experience with specific military items."

"Manufacturers with security clearance."

Who is invited to bid?

"Manufacturers who have regis-

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***How to Sell to the U. S. Army*—Available from the Signal Corps Procurement Agency, 2800 S. 20th St., Philadelphia, Pa.; also from Supt. of Documents, Government Printing Office, Washington 25, D. C. Price 30 cents; also from the Central Military Procurement Information Office, Pentagon Bldg., Washington 25, D. C.**

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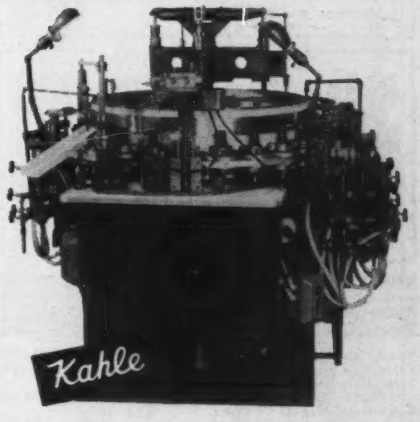

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tered with the procurement office and have satisfied the government that they are qualified to make a specific product."

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"Any one, however, may request and receive an invitation to bid on advertised contracts by demanding this privilege."

What are YOUR chances of getting defense contracts as a prime contractor?

Right now the odds are not good. There isn't enough business to go around. Too much production capacity and limited military requirements mean idle machines and manpower. Efforts to spread war contracts are having some results but you still can't get what isn't there. Given a little more time, there will be greater opportunities because defense spending is still growing. In the meantime it will be tough going. Development of "austerity" products; re-engineering of products using less of scarce materials, and continued development of civilian markets all afford a manufacturer opportunity to continue operating profitably.

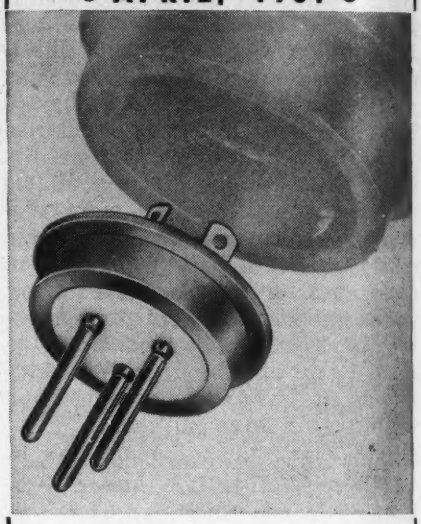
What are YOUR chances as a subcontractor?

Subcontracting affords the best opportunity for getting some defense business. Top-level efforts and directives are specifically designed to spread war work and military services are making reasonable efforts to implement these directives. In some cases, prime manufacturers are having pressure brought to bear on them to subcontract every possible component and much progress has been made in spreading defense work as a result.

The Signal Corps purchases end items, primarily, so component manufacturing is mostly a subcontracting proposition.

Even, here, however, subcontractors will run into difficult situations. Especially in the case of classified contracts. You cannot get a classified subcontract without security

● APRIL, 1951 ●



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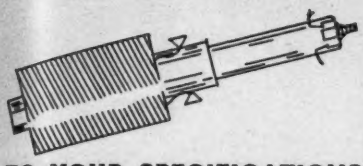

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clearance and you cannot get security clearance without a classified contract. The Signal Corps Procurement Agency will not itself initiate a request for security clearance for a subcontractor. But a prime contractor can do this. It remains for the potential subcontractor to sell his facilities sufficiently to a prime contractor to induce him to request security clearance for you.

Basic Points of Procedure

There are specific, prescribed routines to be followed in organizing yourself for the job of getting defense business as a prime and subcontractor. These are sound and necessary procedures and are similar regardless whether you seek Navy, Air Force or Signal Corps business. These suggestions were discussed in detail in the first article of this series, "How to Sell to the Navy," which appeared in the previous, March 1951, issue of TELE-TECH, beginning on page 30. It should not be necessary to repeat or duplicate this advice which actually appears in the text on page 33 of the first (Navy) article on this subject.

The key points, however, as developed in detail in the first article on this subject, are:

1. Prepare a complete report on your facilities, capacilities, personnel, etc.
2. Itemize specific products which your plant can make and has made. If any item specifically meets government specifications, emphasize this fact.
3. Take along samples of components that meet government standards, if possible.
4. Register with every procurement office shown on the Signal Corps procurement chart.
5. Attempt to visit both chief engineers as well as purchasing agents of private industry; engineers and contracting officers in government.
6. Research and development contracts are handled through special procurement offices, as shown in the chart. Direct your sales effort in the right place, accordingly.

Specifically, in the case of the Signal Corps, the Contracting Division includes an Equipment Branch and a Component Branch. Each branch has a sub-breakdown of Sections by commodity. Study the accompanying chart and note this breakdown and identification of the Commodity Section by specific product. This information should save much effort in getting to the right place and seeing the right men according to what you have to sell.

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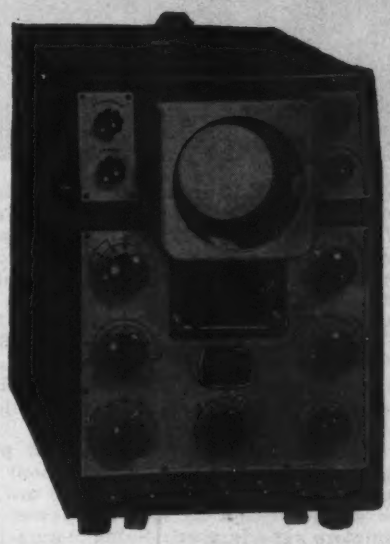

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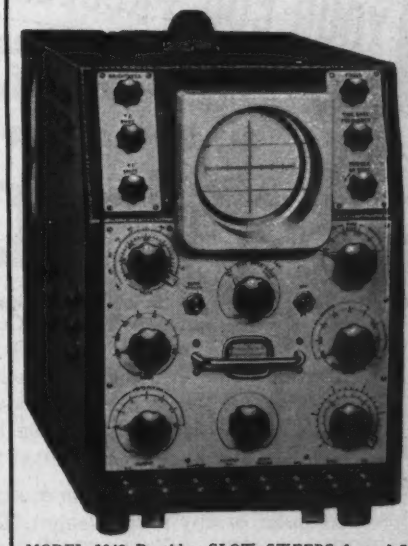

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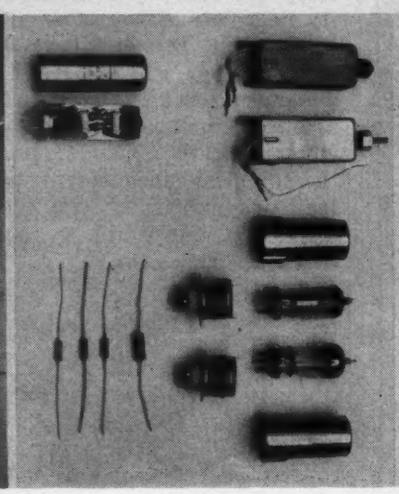

The AN/PRC-10 is a new walkie-talkie model designed to replace type SCR-300, which became so well known during World War II. New Equipment has approximately twice the range as the earlier version and has been reduced in size and weight to about one half. Photo at left shows Maj. Gen. S. B. Akin, Chief Signal Officer, U. S. Army, using SCR-300 carried by Pfc. D. DeWitt of Oakland, Calif. Sgt. J. Muszyski of Detroit, Mich., carries new AN/PRC-10 being used by W. A. Buck, vice president and general manager of RCA Victor Division, with W. W. Watts, Chairman of Production Executive Committee, Defense Production Authority in Washington, D. C., looking on.

Center photo shows miniaturized plug-in type i-f stage (upper left) in contrast to equivalent elements replaced in earlier model. Subminiature tubes are employed throughout the design except for the final power output stage where a miniature type is used. Subminiature i-f tube and all miniaturized components are mounted on the plug-in form, as shown under magnifying glass at right, and then hermetically sealed in metal container. Germanium crystals are employed in place of tube diodes, and coil "Qs" approach 100 in spite of extremely small size. In the overall, the AN/PRC-10 transceiver measures 3 in. deep x 9½ in. high and 10½ in. wide. It weighs only 9 lbs. and the entire equipment including battery power supply, carrying harness, handset, two antennas, operating handbook and spare parts weigh 25 lbs. Other outstanding new features include: afc control on master vhf oscillator of transmitter, spring ribbon steel type antenna to replace earlier tubular type, and operating range increased to about 5 miles.

The AN/PRC-10 model has been made available to the Signal Corps, in the record time of 36 months. Original estimates placed the time required for engineering development, tooling, purchasing and start of mass production at 55 months. Because of the emergency this time factor was subsequently reduced to 44 months but by having production departments looking over design engineer's shoulders earlier delivery was made possible.

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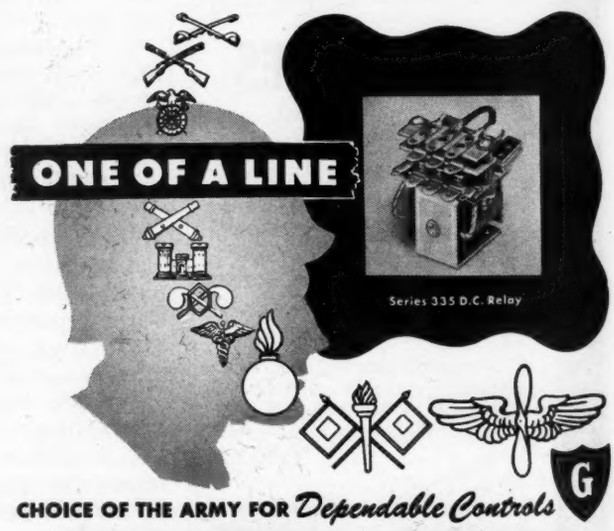

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TELEGRAPHIC COMMUNICATION

(*Continued from page* 42)

selected for the anticipated extension of this system to cities in the South and Midwest. These radio links replace pole lines which have higher maintenance and replacement cost, and will provide a vastly increased number of telegraph channels. They will also improve service by virtually eliminating circuit interruptions caused by storms and other electrical disturbances. This plan is being adapted to long distance communications with relay stations using parabolic reflectors every 25 to 40 miles.

The grouping of various types of telegraph circuits into voice-bands has been found convenient for the reason that some trunk systems make use of pairs of wires for the transmission medium; others, telephone channels derived from Western Union wire carrier systems or leased telephone circuits. Thus grouping provides a method for translating and stacking voice-bands until all of the available signaling spectrum is filled. This method also facilitates the patching or switching of circuits in case of failure without reconnecting each telegraph channel individually.

The largest bandwidth utilized in Western Union wire line practice is approximately 32 KC, which is sufficient frequency spectrum to provide 8 two-way voice bands (on a 4-wire basis). Following this practice, it was decided to design the initial radio beam for 32 voice-bands and increase the number of systems for any required capacity over this value. This number of voice-bands would result in a total capacity of 2048 simultaneous transmissions, half in one direction and half in the other, and since our telegram requires about one minute for transmission, each office could receive over 1000 messages per minute.

In its present networks, large as they are, Western Union does not immediately require all this inter-city capacity. Therefore, approximately half of the available voice-bands will be reserved for an alternate route transmission.

This capacity is satisfied by a band width of 150 Kc. In transmission double modulation is used, that is, the 150 Kc. band of input frequencies from the voice-band equipment frequency-phase modulates a 1 Mc. sub-carrier, and this sub-carrier in turn frequency modulates the final carrier which is in the order of 4000 Mc.

At each repeater the received signal is heterodyned to an intermediate frequency of 32 Mc., and after amplification and limiting the signal is demodulated by passing it through a discriminator. The derived output is the 1 Mc. sub-carrier which then modulates the on-going transmitter. Double demodulation is used only at the receiving terminal, thus making the original input frequencies available for dissection into voice-bands and telegraph carrier channels.

Extensions of Western Union radiotelegraph installations are planned generally in the form of triangular relay systems which will replace trunk pole line facilities as soon as existing contracts permit. Experimentally, the company has been active in exploring the possibility of using its telegraph beam repeater towers as a mounting for parallel intercity television transmissions. These extremely broad-band modulations may also prove useful for future exploitation of high-speed intercity facsimile telegraph systems.

Among advocates of the use of facsimile for non-photographic black-and-white recording, the telegraph company is almost unique in that it actually uses them! Since 1935 facsimile has found increasing usage in handling telegrams, until today there are some 2500 machines in daily use, in over a dozen cities, handling over 2.5 million telegrams per year.

Facsimile is compatible with Western Union's switching-center printer trunking system because it can be economically employed to get patrons' messages quickly and accurately into the printer system at points of origin and then to get them out again at points of destination to the parties for whom they are intended. In a countrywide system where an operator at a keyboard is to handle a message but once, and that at point of origin, the short-haul facsimile method is the perfect answer to the problem of getting the message in front of this operator exactly as it was prepared by the sender, and in jig time.

Facsimile machines come in various types, but most of them turn out copy at a speed of 14.4 sq. in. per minute scanning 100 lines to the inch and 10,000 picture elements per square inch. The modulating side bands are 1250 cycles wide, usually superposed on a 2500-cycle carrier. A tone within this band is used to discharge drums, strip copy off the machines, and generally to put them through automatic sequences. Operators do little but insert and remove messages and blanks, and in some types of machine even these operations are automatic.

Fig. 2 shows the Desk-Fax Transceiver for substation or patron offices. An Auto-Fax Transmitter for semi-

The shifting over to defense work can cause plenty of headaches. The old familiar problems of new specifications, shortages, manpower, equipment, schedules, etc., etc., are approaching us again. We can't help solve all your problems, but we probably can save you several aspirins when it comes to springs, coils and wireforms.

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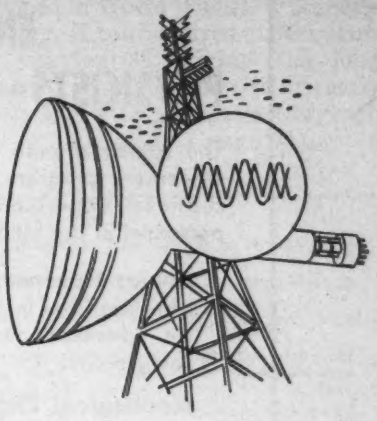

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TelegraphicCommunication

(*Continued from page* 89)

public locations is shown in Fig. 2. The central office concentrator is equipped with 4 vertical drum transmitters and 6 page recorders. Fig. 5 shows a concentrator with a capacity of 100 lines.

A voice-frequency main-line carrier channel 3000 cycles wide will yield only one facsimile circuit capable of scanning one average-length message a minute. The same 3000-cycle band can accommodate 16 teleprinter channels easily, each capable of handling two telegrams a minute. Main-line facsimile's production, for a given amount of band-width, is therefore only 1/32 that of teleprinters. This handicap will limit the use of facsimile on long distance lines until facilities (through the use of radio-beam, for example) become plentiful. Already, voice channels are generally available about town, so facsimile is entirely practical for local pick-up and delivery of telegrams.

These problems of economical "terminal handlings" continue to tax the resourcefulness of telegraph engineers, and probably always will. A frontal assault is being made on the problem in Baltimore, where 8 Telecars (see Fig. 3), outfitted with facsimile machines actuated by VHF transmission from 4 control towers, will roll through the suburbs, continually picking off the air the grist of telegrams to be delivered, and transmitting by radiophone to Baltimore main office those picked up enroute. The roving car is, at the moment, an economic enigma which the engineers are trying to pin down. Meanwhile the customers are the beneficiaries, for never have they been served telegrams so "hot off the griddle."

In all the developments which have been described, telegraphy may be thought of as being teamed with radio equipment in push-pull — it has carried its share of the load. It was while searching for a harmonic telegraph that Pupin brought to full flower the theory of inductance and capacitance in resonant circuits, as Bell before him had stumbled on the telephone in the course of the same research. Basic analyses of transmission problems by Milnor after Fourier, pointed to the superiority of the complex standing wave as an analytical tool over the less adaptable transient theory, and has been widely accepted in fields far removed from submarine cables, its locale of original application. The design of cable amplifiers for very low frequencies proved useful to researchers working on electrocardiographs

and electroencephalographs. Refinement in the design and control of tuning forks for accurate motor speed control was not only fundamental to the regenerative telegraph repeater but later proved basic to much instrumentation in piezo-electric and magnetostriction circuitry. Also fundamental to the regenerator were the principles of self-correction of synchronism to the shifting phase of incoming signals — "locking into step" —a telegraph expedient which finds its acme in television synchronizing circuits. Time-division multiplexing, old art in telegraphy, found recrudescence in the multiple-channel pulse —operated radio telephone techniques developed in World War II. Facsimile scanning, of course, fired experimenters' imagination during the long search for television, Zworykin's early association with facsimile telegraph

(*Continued on page* 94)

COLOR-TV TABLE

(*Continued from page* 33)

(10) To allow present receivers to receive color transmissions in color.

(11) Quality comparison of monochrome picture from color transmission with monochrome picture from monochrome transmission.

(12) These changes do not consider the use of single trichromatic cathode ray tubes. In columns 108M and 108C letters a to i mean the following:

a. Change H and V sync components.
b. Change H and V deflection components.
c. Make power supply adequate, including hum protection. Subcommittee members disagreed on the necessity for this, without further tests.
d. New high-voltage circuits.
e. Add dot modulator with its power supply.
f. Add color phaser. This is optional, since phasing may be accomplished manually.
g. Add color disk and drive and synchronizer.
h. Add magnifier (optional).
i. Add video projection unit, including color switching circuits and associated power supply.

The above list of modifications presumes a picture of minimal brightness and 10-inch size with a magnifier.

(13) The performance is substantially equal to that of system A1. There may be slight degradation on strongly colored objects.

(14) Mr. Smith reports that the receiver noise becomes more visible in fringe areas. Also that the resolution becomes poorer. Mr. Goldmark does not concur with this, but proposes further tests to clarify the question.

(15) This assumes that the receiver takes advantage of dot interlacing.

(16) This applies when using single tube and color disk. Flicker may be roughly equal to standard black and white when using three long persistence phosphors and projection type receiver as in CBS demonstration of April 26, 1950.

(17) This applies to interline flicker and crawl. Present information is insufficient to evaluate inter dot flicker and crawl.

(18) Superior for most objects. In areas of pure primaries (red, blue or green) inferior by a ratio of 48 to 60.

(19) Same as system C2 when using receiver with single tube and color disk. Absent when using three long persistence phosphors and projection type receiver as in CBS demonstration of April 26, 1950.

(20) Present monochrome receivers will receive transmissions with detail equal to that of system C2. It may not be practicable to add equipment for dot interlace reception to receivers now in the hands of the public.

(21) The receiver will need the following additional equipment: Inverse sampler; picture translator; power supply.

(22) Present information is insufficient to evaluate effects of inter-dot flicker and crawl and of dot structure in picture. Otherwise the answer is "equal."

(23) Receiver will need following additional equipment: Three-channel video amplifier, picture translator, power supply.

(24) Present information is insufficient to evaluate effects of fine grain pattern in picture. Otherwise the answer is "equal."

(25) These figures apply to normal subject material. With certain special test patterns the resolution may be less. With a standard test chart printed in black on a background of one of the primary colors, the color of the background in the vertical wedge will desaturate progressively toward the fine end of the wedge. The same test chart printed in one primary color on a background of another primary color will show decrease of detail in the range corresponding to "mixed highs."

(26) Due to the effect of crosstalk and spurious components, generated in this sampling process, the horizontal resolution obtainable in the individual primary color images may be somewhat less than in monochrome.

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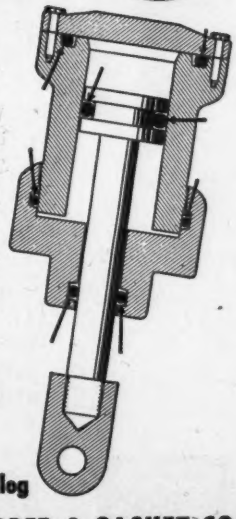

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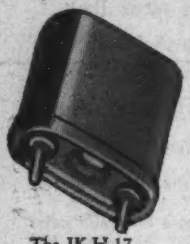

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BULLETINS

Ammeter

A sixteen-page manual, No. 110, "How to Make Your Job Easier with the Amprobe", the pocket-size, snap-on volt ammeter, is now available from Pyramid Instrument Corp., 49 Howard St., New York 13, N. Y.

Reference Book

The 1951 edition of the RCA Reference Book, has been completed by the RCA Tube Dept. at Harrison, N. J., and is being shipped to RCA Tube and Parts Distributors, for issue to engineers, technicians, and purchasing agents. The popular reference book, in addition to being a finger-tip source of essential electronic information, is also a diary, calendar memo, address book, and world atlas.

Production Facilities

Hoffman Radio Corp., 3761 So. Hill, Los Angeles 7, Calif., has issued a comprehensive 40-page booklet, 8 x 10 size, describing the military production facilities of the West Coast organization.

Selenium Rectifier Handbook

The Rectifier Division of Sarkes Tarzian, Inc., has recently published a 64-page Selenium Rectifier Handbook containing practical information on power conversion and suggested applications of selenium rectifiers. It is available from Sarkes Tarzian, Inc., Rectifier Division, 415 North College Ave., Bloomington, Ind. Price is 25 cents.

Precious Metal Alloys

Comprehensive technical and application data on Ney precious metal alloys developed for use in industrial fields are contained in a new catalog and data book now available from the J. M. Ney Company of Hartford, Conn. In addition to physical properties and use and test data on individual alloys, the new catalog contains complete data on standard contact and formed brush shapes now being manufactured by the company.

Laminated Plastics Catalog

Taylor Fibre Co., Norristown, Pa., manufacturers of Vulcanized Fibre, Phenol Fibre and Special Glass Melamine and Silicone Laminates, has announced publication of its new 1951 catalog entitled, "Taylor Laminated Plastics".

Telegraphic Communication

(*Continued from page* 93)

being a case in point.

Dozens of lesser instances can be cited where telegraph has paid or is now paying its debt to radio and electronics — the time-honored result of exchanging ideas with scientists and engineers working in allied fields. This, too, has been done in the time-honored way: through patent disclosures, publication in trade periodicals, and activities in technical societies. And now that the telegraph company is boldly projecting its transmissions into the super-high-frequency range, it may be expected in the future, even more than in the past, to "stay hitched" and to keep pace with new art.